Engineering Library

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The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.

PROGRESS OF THE

ENGINEERING, SHIPBUILDING,

AERONAUTICAL

and

TRANSPORT INDUSTRIES

in 1929

(With an Eight-page Supplement).

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PUBLIC NOTICES

Applications are Invited for the POST of SENIOR TECHNICAL ASSISTANT in the Admiralty Technical Pool, to fill a vacancy at the Admiralty Compass Department, Slough.

Candidates should have had workshop experience in light mechanical engineering and preferably in a supervisory or inspecting capacity. A knowledge of low-power electrical machinery and of testing methods applicable thereto, together with ability to read and interpret mechanical and electrical drawings, are also required.

The scale of salary is £200, rising by annual increments of £10 to £290, plus Civil Service bonus, making a present commencing total of £299 per annum.

Preference will be given to ex-Service men.

Applications, together with copies of testimonials, should be forwarded to the SECRETARY OF THE ADMIRALTY (C.E. Branch), Whitehall, London, S.W. 1, not later than January 13th, 1930. No application forms are required. 4067

Applications are Invited for the POSTS of TECHNICAL ASSISTANT in the Admiralty Technical Pool, to fill the vacancies at the Admiralty Compass Department, Slough.

Practical knowledge of, and training in, light mechanical engineering with workshop and drawing-office experience are required. An elementary knowledge of electrical principles and their applications in electrical test rooms are essential qualifications. The scale of salary is £140, rising by annual increments of £10 to £190, plus Civil Service bonus, making a present commencing total of £219 per annum. Preference will be given to ex-Service men.

Applications, together with copies of testimonials, should be forwarded to the SECRETARY OF THE ADMIRALTY (C.E. Branch), Whitehall, London, S.W. 1, not later than January 13th, 1930. No application forms are required. 4068

Crown Agents for the Colonies.
COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are INVITED for the following POST :—

M/1758.—ASSISTANT ENGINEER REQUIRED for the Kenya and Uganda Railway and Harbours for a tour of 20 to 30 months' service and possible extension. Salary £480, rising to £720 a year by annual increments. Free quarters and passages and liberal leave on full salary. Candidates, 22-28 years of age, unmarried, must have passed Sections A and B of the examinations to qualify for Associate Membership of the Institution of Civil Engineers, or hold professional qualifications recognised by the Institution as exempting from those examinations. Should have had some experience on Railway Civil Engineering Work, but applications from Junior Engineers who have served pupilage and had subsequent experience with consulting engineers or on some large construction other than railways will be considered.

Apply at once by letter, stating age and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/1758. 4109

Ministry of Transport.
ROADS DEPARTMENT.

APPLICATIONS are INVITED for the POST of SENIOR ASSISTANT-IN-CHARGE at the Ministry's Road Experimental Station at Harmondsworth, near Colnbrook, Middlesex, on the scale £500-25-600 plus bonus, commencing at the minimum. The present bonus on £500 is £171 15s. Preference will be given to men who have served in His Majesty's Forces.

Candidates should possess an Honours Degree in Physics with good research experience. The duties attaching to the appointment include the initiation of experiments and the control of staff engaged upon research work in connection with road materials, the improvement of the construction of roads and the effect of various types of vehicles on roads.

Forms of application can be obtained from the ESTABLISHMENT OFFICER, Ministry of Transport, Whitehall-gardens, S.W. 1. Applications can only be received on the recognised forms and should reach the Ministry of Transport on or before the 18th January, 1930. 4106

Crystal Palace School of Practical Engineering.
Principal : MAURICE WILSON, M. Inst. C.E.

EASTER TERM BEGINS on JANUARY 8th. New Students are admitted on the previous day. 4085

CITY OF LONDON.
The Sir John Cass Technical Institute.
JEWRY-STREET, ALDGATE, E.C. 3.
Principal : GEO. PATCHIN, A.R.S.M., M.I.M.M.

"LAW AND INDUSTRY."

A COURSE of TEN LECTURES on the above subject will be delivered on TUESDAY EVENINGS, at 7 p.m., commencing Tuesday, January 14th, 1930, by

G. S. W. MARLOW, B.Sc., F.I.C.,
Barrister-at-Law, Gray's Inn.

The Lectures will deal with English Law as it affects industrial operations, and will include such subjects as Negligence, Nuisance, Master and Servant, Sale of Goods, Patents, Company Law, &c.

The Course meets the requirements of those holding, or wishing to qualify themselves to hold, responsible executive appointments, and no previous legal knowledge is assumed.

The fee for the Course is 12s. 6d.

Further particulars of this and other Evening Courses in Physics, Mathematics, Chemistry and Metallurgy can be obtained on application to the PRINCIPAL. 4073

Egyptian Government.
EGYPTIAN UNIVERSITY,
FACULTY OF SCIENCE.

APPLICATIONS are INVITED for the POST of LECTURER in PHYSICAL and STRATIGRAPHICAL GEOLOGY.

The salary offered is £E700 to £E800 (approximately £718 to £820) a year.

The appointment will be on contract for three years and renewable at the end of that time.

A transfer allowance equal to one month's salary will be paid to the successful applicant if resident in Europe.

Applications, together with copies of three recent testimonials, should be addressed to the DEAN OF THE FACULTY OF SCIENCE, Egyptian University, Cairo, so as to be received not later than January 31st, 1930. 4026

City of Aberdeen.
WATERWORKS.
TO CONTRACTORS.
OLD AQUEDUCT REPAIR.
CONCRETE LINING.

The Town Council of the City of Aberdeen invite TENDERS for LINING with CONCRETE the INTERIOR of the OVAL-SHAPED 3ft 9in. by 3ft. 3in. BRICK AQUEDUCT, about 18 miles in length, and ANCILLARY WORKS between Invercannie and Mannofield, Aberdeen.

Drawings may be seen, and specifications, schedules of quantities and forms of Tenders obtained on payment of £3 3s. (which will be returned on receipt of a bona fide Tender) for each copy, from the undersigned.

Intending offerers can be shown over the works on Tuesdays, 31st current, and 7th January, also Fridays, 3rd and 10th January, leaving the Town House at 10 a.m. on Tuesdays and 1 p.m. on Fridays.

Sealed Tenders, addressed to the Town Council of Aberdeen, and endorsed "Tender for Old Aqueduct Repair," to be lodged with the undersigned not later than 10 a.m. on Tuesday, the 14th day of January, 1930.

The Town Council do not guarantee the acceptance of the lowest or any Tender, and parties tendering do so at their own expense.

THOS. F. HENDERSON, M. Inst. C.E.,
Burgh Surveyor and Water Engineer.
Town House, Aberdeen,
26th December, 1929. 4071

Slough Urban District Council.
WATER PUMPING PLANT.

The Council invite TENDERS for the INSTALLATION of TWO SETS of MOTOR-DRIVEN CENTRIFUGAL PUMPS to lift water from a 36in. diameter bore-hole to high and low-level reservoirs.

Particulars can be obtained from, and Tenders endorsed "Pumping Plant" should be delivered to the undersigned before Noon on Friday, the 24th January, 1930.

ALAN BROMLY, A.M.I.C.E.,
Water Engineer.
William-street, Slough,
3rd January, 1930. 4097

State Electricity Commission
OF VICTORIA, AUSTRALIA,
22-32, WILLIAM-STREET, MELBOURNE, AUSTRALIA.

TENDERS are hereby INVITED for the SUPPLY and DELIVERY at Yallourn Power Station of REFRACTORY BRICKS for BOILER FURNACES, in accordance with Specification No. 30/7.

Copies of Tender form, specification, &c., will be available upon application to the Agent-General for Victoria, Victoria House, The Strand, London, England.

Charge 5s. for set of two copies complete, returnable under certain conditions as specified in the general conditions of tendering. Extra copies 2s. 6d. each, not returnable.

Tenders, on prescribed form, properly endorsed and addressed and accompanied by a preliminary deposit of £50, must be delivered to the undersigned in Melbourne not later than the 17th February, 1930.

The Commission does not bind itself to accept the lowest or any Tender.

W. J. PRICE,
4069 Secretary.

Ham Urban District Council.

The Council are prepared to receive TENDERS for ALTERATIONS to TANKS, ENGINE-HOUSE and PUMP WELL, and the PROVISION and ERECTION of PUMPING PLANT and other WORKS at the Sewage Disposal Works, Lock-road, Ham.

Specification and drawings may be inspected and copies of the quantities obtained at the office of Messrs. William Fairley and Co., Chartered Civil Engineers, Parliament Mansions, Westminster, S.W. 1, and at the office of Mr. E. F. Ogburn, Surveyor to the Council, Council Offices, Lock-road, Ham, Surrey.

Sealed Tenders, on forms provided, must be received by the undersigned not later than Twelve o'clock Noon on Tuesday, the 14th January, 1930.

The Council do not bind themselves to accept the lowest or any Tender.

S. C. T. LITTLEWOOD,
Clerk to the Council.
14, Church-street, Kingston, Surrey,
30th December, 1929. 4075

Parish of Reading.
TO HEATING AND ELECTRICAL ENGINEERS.

The Guardians of the Poor of the Parish of Reading invite APPLICATIONS from firms desirous of TENDERING for the undermentioned WORKS at the New Casual Wards, to be erected at Woodley, Berks.

SECTION 1.
The Central Heating, Domestic Hot Water, Disinfecting and Drying Services.

SECTION 2.
The Electric Lighting Installation, the Supply of Electrical Energy for which will be taken from the Mains of the Thames Valley Electric Supply Company, Limited.

The firm whose Tender or Tenders may be accepted will be required to give security, to be approved by the Guardians, for the due performance of the contract, and to pay to the workmen employed on, or in connection with, the work the appropriate trade union rate of wages.

Persons desirous of tendering must, in the first place, make application to the Board's Consulting Engineer, Mr. John Wayne-Morgan, M. Cons. E., 6, Church-road, Whitchurch, Cardiff, on or before the 8th instant, and must send with the application a deposit of £2 in respect of each section, for which they wish to Tender. Such deposits will be returned in full on receipt of a bona fide Tender in the manner and at the time which will be appointed by the Board.

The Board does not bind itself to accept the lowest or any Tender.

By Order of the Board,
W. H. OLIVER,
Clerk to the Guardians.
32, Thorn-street, Reading,
1st January, 1930. 4072

The Metropolitan Asylums Board invite TENDERS for the DRY-DOCKING and REPAIR of the HULL and FITTINGS of the RIVER AMBULANCE STEAMER "WHITE CROSS."

Specifications, conditions of contract and form of Tender may be obtained at the office of the Board, Victoria Embankment, E.C.4.

Tenders, addressed as noted on the form of Tender, must be delivered at the office of the Board not later than 10 a.m. on Wednesday, 22nd January, 1930.

ALLAN POWELL,
4088 Clerk to the Board.

PUBLIC NOTICES

City of Birmingham Education Committee.

APPLICATIONS are INVITED from qualified candidates for APPOINTMENT as ENGINEER (for Heating and Lighting) on the permanent staff of the Education Committee. The person appointed will be required to devote the whole of his time to the service of the Committee, and will be paid a salary of not less than £500 and not more than £600 a year. The actual salary will be determined by the Committee having regard to the experience and qualifications of the successful candidate. The appointment will be subject for its termination to three months' notice on either side.

The successful candidate will be required to pass a medical examination and to contribute to the Local Superannuation Scheme.

A form of application for the appointment, a list of the duties attached to the post, and other particulars in regard thereto, may be obtained from the Chief Education Officer. A stamped addressed envelope should be enclosed.

Applications must be submitted on the official form of application, and should be sent to the CHIEF EDUCATION OFFICER, Education Offices, Margaret-street, Birmingham, not later than the first post on Monday, 20th January, 1930.

Canvassing will disqualify. 4099

City of Leicester.
SUPERINTENDENT—SEWAGE PUMPING STATION.

APPLICATIONS are INVITED for the APPOINTMENT of SUPERINTENDENT at the Abbey (main) Sewage Pumping Station, Corporation-road, to Take Control of the Staff, the Supervision of the New Detritus and Storm Water Tanks, also the Steam and Electrical Plant, which includes Four 200 H.P. Beam Engines and Pumps, Eight Boilers, Electrically-driven Triple-ram Pumps, Duplex Sludge Pumps and Screens.

Age limit 30 to 45 years.

Commencing salary £350 per annum (inclusive), rising by £20 to £450 per annum, Grade "F." The Superintendent will be required to reside in house adjoining the Pumping Station and pay such rental as may be arranged on appointment.

The appointment will be subject to the Local Government and other Officers' Superannuation Act, 1922, and the successful candidate will be required to pass a medical examination.

Applications, on forms which may be obtained from the undersigned, accompanied by copies of three testimonials of recent date, must be delivered not later than Saturday, January 18th, 1930.

Canvassing will disqualify.

A. T. GOOSEMAN, M. Inst. C.E.,
City Engineer and Surveyor.
Town Hall, Leicester,
December 30th, 1929. 4079

City of Sheffield Water Department.
CONSTRUCTION OF BURBAGE RESERVOIR AND WORKS.
ASSISTANT ENGINEERS.

APPLICATIONS are INVITED for the APPOINTMENTS of FIRST and SECOND ASSISTANT ENGINEERS in connection with the Construction, by direct labour, of a Large Storage Reservoir and Works on the Burbage and Houndkirk Moors, situate 7 miles from Sheffield.

Salaries £400 and £300 per annum respectively.

FIRST ASSISTANT.—Applicants must be qualified engineers, and have had practical experience in the design and construction of impounding reservoirs, with earth embankments, including the setting out of work and the control of workmen.

SECOND ASSISTANT.—Applicants must be qualified engineers, and experienced in the preparation of plans and specifications for works of reservoir construction.

The persons appointed will be required to enter upon the duties at once, reside in the vicinity of the works, and devote the whole of their time to the service of the Corporation.

Applications, stating age, qualifications and experience, accompanied by copies of recent testimonials, and endorsed "First" or "Second Assistant Burbage Engineer," to be sent to me not later than Monday, 13th January. Canvassing will disqualify.

WILLIAM TERREY,
General Manager.
Waterworks Office, Sheffield
20th December, 1929. 4087

Doncaster District Drainage Board.
APPOINTMENT OF ENGINEER.

APPLICATIONS are INVITED for the POSITION of ENGINEER to the Board from Engineers having land drainage experience.

The salary offered is £800 per annum. Office accommodation and staff will be provided by the Board.

Particulars of the duties may be obtained upon application to the undersigned.

Applications, endorsed "Engineer," stating qualifications and accompanied by not more than three recent testimonials, must be received by the undersigned not later than the first post on the 17th January, 1930.

Canvassing will be a disqualification.

W. BAGSHAW,
Acting Clerk to the Board.
Town Clerk's Office, Doncaster. 4086

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For Advertisement Rates see Leader Page.

PUBLIC NOTICES

South Staffordshire Water-
WORKS COMPANY.
MECHANICAL DEPARTMENT.

APPLICATIONS are INVITED for the APPOINTMENT of SECOND MECHANICAL ENGINEERING ASSISTANT.

Candidates must be good draughtsmen and have had considerable experience in the design and construction of large pumping units, including steam and Diesel oil-driven plants; also in the maintenance and upkeep of all classes of machinery appertaining to a large waterworks undertaking.

Commencing salary £350 per annum, which is subject to deductions under the Company's Superannuation Scheme.

Applications, stating age, details of education, training, qualifications and experience, accompanied by copies of recent testimonials, must be addressed and delivered to the undersigned not later than Wednesday, the 15th January, 1930.

FRED. J. DIXON, M. Inst. C.E.,
Engineer-in-Chief.

23rd December, 1929.
Engineer's Office,
26A, Paradise-street Birmingham. 4066

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, ENGINEER, Preferably Marine Experience, to Operate Small Generating Station in East Africa. Experience desired de Laval Turbo-alternators, Water-tube Boilers, Condensing Plant. Three years' contract, free passages, housing, servants, medical attendance. Cost of living for bachelor approximately £12 a month. Salary commencing £400 per annum.—Apply by letter, stating qualifications, to Box J. N., c/o Davies and Co., 95, Bishopsgate, E.C. 2. 4105 A

WANTED IMMEDIATELY for British Mandated Territory with good climate, within a week of London, MANAGER for Electric Light and Power Company. Age not over 40. Must have good technical and commercial qualifications and experience in similar position abroad desirable.—Write, stating age, experience, salary expected, and when free, to Box 809, c/o Judds, 47, Gresham-street, London, E.C. 2. 4108 A

WANTED, Near London, SEVERAL GOOD WELDERS for Welding Joints on Large and Small Steel Tubes. Only skilled and first-class men with good experience of welding joints in trenches, &c., need apply.—Apply in writing only, stating age and experience, with copies of testimonials, &c., to WILLIAM PRESS and SON, Contractors, 36, Old Queen-street, Westminster, S.W. 1. 4043 A

WANTED, WORKS MANAGER for Small (Growing) Engineering Works in outskirts of London. Full details of experience and salary required.—Address, 4076, The Engineer Office. 4076 A

WANTED, Young ASSISTANT CIVIL ENGINEER, preferably with B.Sc. (Engineering) or equivalent Degree, for Technical Department of London Office; good draughtsmanship and sound theoretical knowledge essential. Excellent prospects for the right man.

Apply (letter only), stating age, experience, qualifications, and salary required, to the BRITISH STEEL PILING CO., Ltd., 54A, Parliament-street, Westminster, S.W. 1. 4082 A

A MANAGING ENGINEER for Modern London Firm manufacturing brick and other building products. Only applicants capable of opening up works and controlling existing ones need apply. Share interest may be arranged for suitable applicant.—Write in first instance, stating salary required, age, experience and qualification, in confidence, to CHAIRMAN, Box No. 285, c/o Pool's Advertising Service, 180, Fleet-street, E.C. 4. 4083 A

AN ASSISTANT ENGINEER, Experienced in the design of Locomotives, is REQUIRED in a London office. Commencing salary £400 per annum (plus Civil Service cost-of-living bonus at rates current from time to time), rising to £525 per annum (plus bonus). The bonuses at present payable are approximately as follows:—On £400, £147; on £525, £160. Applicants should be between 30 and 40 years of age and have been trained with an important railway company. They must possess a sound practical and theoretical knowledge of modern locomotive practice.—Address, 4095, The Engineer Office. 4095 A

THE MOND NICKEL COMPANY, LTD.

APPLICATIONS are INVITED from a METALLURGIST or ENGINEER for a post at the London Offices. Experience of Office Methods and/or Patent Procedure advantageous. Salary £350 per annum.

Applications, addressed MANAGER, Research and Development Department, The Mond Nickel Company, Ltd., Imperial Chemical House, Millbank, London, S.W. 1. 4100 A

ESTIMATING ENGINEER, Capable of Conducting Correspondence, REQUIRED for London. Must have had experience in Boilermaking. Preference given to candidates who are Graduates in Engineering and have works experience. A knowledge of principles of heat transmission essential.—Full particulars of qualifications, training and experience, with copies of recent testimonials, should be addressed 4080, The Engineer Office. 4080 A

FIRM of PATENT AGENTS REQUIRES ASSISTANT for Search Department; previous experience not essential, but applicant must have had a good technical education.—Address, stating age, qualifications, and salary required, 4091, The Engineer Office. 4091 A

FIRM of CIVIL ENGINEERS in Westminster REQUIRE an ASSISTANT with knowledge of detailing for Structural Steel Work. Some experience of architectural work would be an advantage.—Address, 4101, The Engineer Office. 4101 A

GENERAL WORKS MANAGER.—Large FIRM of producing tonnage product employing thousands of hands, invites APPLICATIONS for POSITION of GENERAL WORKS MANAGER PRODUCTION ENGINEER with managerial experience essential.—Write in first instance to SIR ALEXANDER GIBB AND PARTNERS, Queen Anne's Lodge, Westminster, S.W. 1, stating fully qualifications and experience. Commencing salary £4000 per annum. Excellent prospects for right man. 4063 A

HEAD COSTING CLERK, Wide Experience Costing of Small Parts in large quantities. Only first-class man with modern ideas need apply, stating salary and full particulars of past experience.—Address, 4081, The Engineer Office. 4081 A

STEEL WORK DESIGNER.—London Firm of CONSTRUCTIONAL ENGINEERS REQUIRES SERVICES of competent DESIGNER. Previous experience in Steel-framed Buildings and Theatres absolutely essential; also must be conversant with L.C.C. requirements.—Address full particulars, 4077, The Engineer Office. 4077 A

CHIEF or LEADING DRAUGHTSMAN REQUIRED for Engineers in North London. Primary feature, must have had at least 10 years' experience as apprentice, shop practice and design appertaining to Brewery and Dairy Equipment. Also JUNIOR DRAUGHTSMAN. State age, capabilities, salary, and general reply.—Address, 4090, The Engineer Office. 4090 A

DRAUGHTSMAN.—Fully Competent MAN REQUIRED. Must be experienced in design of Elevating and Conveying Equipment and Light Structural Steel Work.—Write full particulars experience and salary to Box No. 367, c/o White's, Ltd., 72-78, Fleet-street, London, E.C. 4. 4070 A

DRAUGHTSMAN REQUIRED, Heating and Ventilating, to prepare schemes, take off quantities, give specifications. Must be thoroughly experienced in all systems, including Plenum.—Address, stating age, experience, and salary required, 4092. The Engineer Office. 4092 A

SITUATIONS OPEN (continued)

DRAUGHTSMAN, with General Experience and initiative, REQUIRED for Engineering Works, W. London. State age, experience, and salary required. London applicants only.—Address, P6522, The Engineer Office. P6522 A

EXPERIENCED DRAUGHTSMAN REQUIRED in the London Office of Contracting Engineers for Conveyor Work. State age, experience, and salary required.—Address, 4094, The Engineer Office. 4094 A

FIRST-CLASS MECHANICAL DRAUGHTSMAN for Works Reconstruction in Kent. Expert knowledge of Elevating and Conveying Machinery essential. Cement Plant experience an advantage. State age and salary.—Address, 4074, The Engineer Office. 4074 A

JIG and FIXTURE DRAUGHTSMEN REQUIRED for Small Accurate Component Production.—Write, stating age, experience, and wages required, Box 154, Advertising Offices, 84, Queen Victoria-street, London, E.C. 4. 4065 A

JUNIOR DRAUGHTSMAN for Sanitary Fittings (Great Bridge district). Wages £2 to £3, according to ability.—Address, 4078, The Engineer Office. 4078 A

LEADING DRAUGHTSMEN WANTED, with expert knowledge of I.C.-engined Tractors for agricultural and industrial purposes; also for I.C.-engined Road Rollers. Excellent prospects and generous salaries for right men. Applications considered in strictest confidence for either line, but preference given to applicant capable of taking both.—Address, 4104, The Engineer Office. 4104 A

TWO Good MECHANICAL DRAUGHTSMEN WANTED. Commence immediately. Preferably used to Steel Works Machinery.—CHRISTMAS and WALTERS, Ltd., Caxton House, Westminster. 4098 A

SITUATIONS WANTED

ENGINEER (MECHANICAL), with 25 Years' Experience in general engineering, steam engines and boilers, pumps, conveyors and elevators, &c., with machine shop, fitting and erecting, and outside representative experience, also electrical engineering knowledge and drawing-office experience, DESIRES SITUATION as ASSISTANT WORKS MANAGER, FOREMAN or TRAVELLER.—Address, P6529, The Engineer Office. P6529 B

ENGINEER, M.I. Mech. E., Sound TECHNICAL and SALES TRAINING, Public School education, experience in Steam Plant, Transport Vehicles, Internal Combustion Engines, Compressors, Fans, &c., London connection, WISHES to HEAR from HIGH-CLASS FIRM well backed by sound advertising needing EFFICIENT REPRESENTATION in LONDON and the HOME COUNTIES.

Product must be of real engineering interest.
Pioneer work not objected to if terms are reasonable.
Address, P6524, The Engineer Office. P6524 B

ENGINEER SALESMAN, Mechanical, Marine and oil, extensive knowledge American marketing developments in Far East, executive experience, socially well connected, available for similar post at home or abroad.—Address, P6540, The Engineer Office. P6540 B

ENGINEER (30) SEEKS CHANGE. Public School education, experienced shops, D.O., assistant engineer, works extensions and maintenance. Salary £350 p.a.—BM/L024, London, W.C. 1. P6526 B

ENGINEER (45), Erecting, Operating and Maintenance of heavy machinery and boiler plants, refrigerating, electric power plants, packing houses, soap works, &c. First Class B.O.T. Certificate, knowledge of Spanish; home or abroad.—Address, P6535, The Engineer Office. P6535 B

EXPERIENCED, Extensively Travelled COMMERCIAL REPRESENTATIVE, with London office, OPEN for REPRESENTATION; good salesmanship ability and up-to-date in publicity methods, keen, active and trustworthy, knowledge of foreign languages.—Address, P6534, The Engineer Office. P6534 B

EXPERIENCED ENGINEER, at Present Chief Engr. Industrial concern, salary £750, WISHES POSITION as MANAGER. Age 42. Unimpeachable record.—Address, P6421, The Engineer Office. P6421 B

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GENERAL MANAGER, to Take Complete Control of Executive Staff. Wide experience of engineering production and new materials and methods. Expert designer.

Has built special production machines and perfected methods which have saved hundreds of pounds. Extensive knowledge of markets gained from travel and sales experience abroad.

All negotiations treated in the strictest confidence. Write, Box F. 71, Willing Service, 86, Strand, W.C. 2. 3553 B

GERMAN CHIEF ENGINEER, of Excellent abilities and untiring energy, 39 years of age, SEEKS new POSITION. Long experience as technical chief in important German firms manufacturing electric motors and apparatus. Familiar with the latest methods of modern economic production and factory organisation for series and mass production, calculations, piecework rates, machine tools, and time studies.
Address, P6528, The Engineer Office. P6528 B

METALLURGIST (23), Honours B.Sc., SEEKS POST, large and varied experience of casting and rolling of non-ferrous alloys.—Address, P6537, The Engineer Office. P6537 B

WORKS MANAGER DESIRES CHANGE. Practical experience in light engineering, press work, stampings, sheet metal work, metal spinning, knowledge of modern factory organisation, or would consider position of Assistant Works Manager, Foreman or Traveller.—Address, P6536, The Engineer Office. P6536 B

DRAUGHTSMAN (27), Married, REQUIRES SITUATION; 4 years shops, 9 years' D.O. experience in centrifugal, rotary and reciprocating pumps. Good references.—Address, P6538, The Engineer Office. P6538 B

FOREMAN BOILERMAKER SEEKS POSITION. Age 33, sea-going water-tube, Scotch, ship and oil tank experience. Spanish and Hindustani spoken.—Address, P6523, The Engineer Office. P6523 B

PARTNERSHIPS

WANTED to PURCHASE PART INTEREST in STEEL FOUNDRY capable of turning out 15/20 tons of steel castings up to 5 tons lot per week, single shaft. Willing to purchase outright if price is right. Preferably within 20 miles of Manchester.—Apply, HERVEY SMITH and SONS, Solicitors, Hyde. 4064 C

CHARTERED CIVIL ENGINEER of Experience would INVEST up to £1000 and GIVE SERVICES in Consulting Engineer's Business or other sound going concern. Every investigation. No agents.—Address, P6527, The Engineer Office. P6527 C

AGENCIES

ENGLISH TECHNICAL ENGINEER, Established in Calcutta 10 years, with office and adequate staff, well known throughout Bengal, United Provinces, Punjab and North-West Frontier, is DESIROUS of REPRESENTING ONE or TWO ENGINEERING FIRMS on reasonable terms. Highest references.—Apply, P.O.B. 2088, Calcutta. P6518 D

ENGINEERS, with Well-established Connection in Yorkshire, are WILLING to TAKE UP REPRESENTATION for leading Engineering Firm. Stores and accessories of no interest.—Address, 4087, The Engineer Office. 4087 D

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INST. OF STRUCTURAL ENGRS.,
UNIVERSITY OF LONDON, &c.
are personally conducted by
Mr. Trevor W. Phillips,
B.Sc., Honours, Engineering, London University, Assoc. M. Inst. C.E., A.M.I. Struct. E., M.R.S.I., F.R.S.A., Chartered Civil Engineer, &c.
For full particulars and advice apply to:—36, DALE-STREET, LIVERPOOL (Tel., Bank 1118). LONDON OFFICE: 65, CHANCERY-LANE, W.C. 2. Ex.

MISCELLANEOUS

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JANUARY 3, 1930.—VOL. CXLIX.

THE ENGINEER.

A Seven-Day Journal

Salving the White Star Liner "Celtic."

THE task of refloating the derelict hull of the White Star liner "Celtic," which went aground nearly a year ago off the entrance to Queenstown Harbour, is presenting more difficulties than were at first expected. It has now been decided, mainly on account of the heavy seas recently experienced, to postpone the refloating operations until next March. The work, it will be remembered, is being carried out by Messrs. Petersen and Albech, of Copenhagen, who are associated with A. O. Hill, Ltd., of Dover, and Cox and Danks, Ltd., of London and Scapa Flow. Preparations had been made to lift the ship by means of compressed air, but the measures taken to render the various compartments air-tight have been defeated by the heavy seas. Meanwhile, a gangway, some 400ft. in length, has been built from the mainland to the ship, giving access to the wreck at all times. An endeavour will now be made to reduce the weight of the ship by removing certain parts of the superstructure, so as to lighten the hull as far as possible before attempting the final refloating operations. We are informed by Cox and Danks, Ltd., that the primary cause of the recent regrettable accident on the "Celtic" in which the firm's salvage engineer, Mr. M. Carmichael, and three workmen lost their lives by gassing and drowning, was a fracture on the discharge connection of a pump which was being employed to empty No. 2 hold before testing it for air-tightness. In order to prevent water from entering the hold, the side ventilation holes, which had previously been open so as to allow the sea to enter, were closed, and it is assumed that noxious gases gained access to the hold space through a trunk and became dissolved in the standing water. When the discharge branch broke, the contaminated water was spilled about the deck in the 'tween space, which became filled with noxious gases and into which the men unknowingly descended.

High Speed Flying.

ALTHOUGH the Government has decided that further participation in the Schneider Trophy seaplane contest shall, so far as this country is concerned, be left to private enterprise, the Air Ministry intends to continue the work of the high-speed flying section of the Marine Aircraft Experimental Establishment, stationed at Felixstowe. Two of the pilots of last year's British Schneider Trophy team—Squadron Leader Orlebar and Flight Lieut. Stainforth—have been retained for the high-speed section, and other pilots for it are in process of being selected. The Schneider Trophy machines were not produced solely for the contest. They have been accepted by the Ministry, and will now be used for important high-speed experimental work. If it is too much to say that the Schneider Trophy machines of to-day are the fighting scouts of to-morrow, it is certainly true that the knowledge accumulated during the production of these machines will directly affect and be applied in the design and construction of new service machines. There are still many points connected with high-speed flight which require study before machines with performances approaching those of the Schneider seaplanes can be brought into general service use. One important subject to be studied is physiological rather than physical, and is bound up with the best method of turning at high speed and the avoidance or minimising of the period of "blacking out" from which the pilot may suffer by reason of the very high accelerative forces to which he is subjected when so turning. It was stated after the Schneider Trophy Race last September that none of the British pilots experienced "blacking out" at the corners of the course. It is possible, however, that this absence of effect arose as much from the exceptional fitness and physical characteristics of the pilots as from the fact that the turning manœuvre employed was especially designed to avoid "blacking out." It is stated that during this manœuvre the acceleration on the machine and pilot rises to the value 4 *g*. An acceleration of 6 *g*, it is estimated, would tax the most highly trained pilot to the utmost, while an acceleration of seven times gravity would, it is believed, prove fatal. It is of interest to note that at the speed which won the Trophy last year, 328 miles an hour, a pilot would experience centrifugal acceleration in excess of 4 *g* if he made a plain turn of less than 1830ft. radius.

The Late Mr. William Brown.

IN the recent death of Mr. William Brown, the chairman and managing director of William Simons and Co., Ltd., shipbuilders and engineers, of Renfrew, the shipbuilders and marine engineers of the Clyde have lost one who was associated with the development and progress of the shipbuilding industry for over sixty years. Mr. Brown was born in Glasgow in 1850, and after receiving his earlier education at the Renfrew and Paisley Grammar Schools, he attended the mechanical and civil engineering courses of Professor Macquorn Rankine, at the Glasgow University. In 1866 he began his engineering apprenticeship in the engine works of William Simons and Co., of which firm his father was a partner with the late Mr. William Simons. He became assistant manager of the engineering department of the firm in 1872, and four years later he was appointed manager. In 1888 he became a partner in the firm, and when it was later converted into a limited liability company he was elected a director. In 1907 he became, on the death of his father, the chairman and managing director of the company, a position which he continued to hold up to the time of his death. Mr. Brown was a member of the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Naval Architects, the Institution of Engineers and Shipbuilders in Scotland, and the American Society of Civil Engineers. He took an active interest in the welfare of Renfrew, and for fourteen years represented the Burgh of Renfrew on the Clyde Navigation Trust. In recognition of his services during the war, the honour of Commander of the British Empire was conferred upon him in 1918, and in 1923 he was presented with the freedom of the Burgh of Renfrew.

Profit-sharing in Co-operative Productive Societies.

STATISTICS recently published giving the results of profit-sharing in co-operative productive societies in 1928 show a slight improvement when compared with those of the preceding year. The section devoted to metal-working and miscellaneous industries include six societies of more or less interest to engineers. These six societies had a total membership at the end of 1928 of 1227, with a share and loan capital of £70,738. A total of 577 workpeople were paid £67,034 in wages. Sales for the year amounted to £231,664, and five societies had an aggregate surplus of £6303 as the result of the year's trading; one—the Leicester Carriage Builders, Ltd.—having a deficit of £156. Only three societies made any distribution of surplus to their employees. Co-operative Sundries, Ltd., of Droylsden, Lancs., with a surplus of £1223, distributed to its 120 employees a total of £249, or 9d. in the pound on wages; the East London Toy Factory, Ltd., had a surplus of £858 (over double that of 1927), and its 17 employees received a bonus of 2s. 6d. in the pound, making an aggregate distribution of £250; the Walsall Lock and Cart Gear, Ltd., with 355 workpeople and a surplus of £3596, distributed £2275, or a bonus of 1s. 3d. in the pound. The Alchester Needlemakers, Ltd., and the Walsall Lock each made an allocation to capital of £332 and £80 respectively, and Co-operative Sundries declared a bonus to purchasers of £877, or 2s. in the pound. Various grants were made by three of the societies to educational and charitable purposes, aggregating £375. The forty-two societies associated with the Federation had a total membership of 14,990, an increase of 539 over 1927. The loan and share capital amounted to £985,101, and together the societies employed 6797 workpeople, the wages bill totalling £719,750. Sales amounted to just over 2¼ million pounds, resulting in a net surplus of £139,717. Of this sum, £7180 was distributed to capital, £34,259 to labour, £57,076 to customers, and £6370 to educational and charitable purposes, part of the balance of £34,832 being added to reserve and part carried forward. These figures are supplementary to those which we published on July 26th last, dealing mainly with profit-sharing in ordinary commercial businesses.

The New Year Honours.

IN the list of New Year Honours issued on December 31st the names of a few engineers and of a few connected with the profession appear. Sir William Noble, the well-known North Country shipowner and ex-President of the Chamber of Shipping of the United Kingdom, and Sir C. C. Wakefield, Chairman of C. C. Wakefield and Co., Ltd., Lubrication Experts, have been created barons. Sir Eustace Tennyson-D'Eyncourt, formerly Director of Naval Construction at the Admiralty, has been made a baronet. A knighthood has been conferred upon Mr. Archibald Page, the Central Electricity Board's chief engineer, and a past-President of the Institution of Electrical Engineers, and upon Mr. A. M. Rouse, Chief Engineer of the Indian Service of Engineers, Delhi. Mr. J. S. Pitheathly, Director of Electrical Undertakings, Ceylon, has received the C.M.G. In the Order of the British Empire, the C.B.E. has been conferred upon Professor J. S. S. Brame, Professor of Chemistry and Metallurgy at the Royal Naval College, Greenwich, and upon Mr. Sidney Stallard, Divisional Road Engineer, Ministry of Transport. Mr. T. S. Hawkins, M. Inst. C.E., of the Ministry of Transport, Captain R. N. Liptrot, Principal Technical Officer, Air Ministry, and Mr. W. Williams, Superintending Inspector of Factories, Home Office, have received the O.B.E. Among the names of those receiving the M.B.E. we note that of Mr. F. C. Duxon, chief engineer of the S.S. "Haiching," of Hong Kong, "for valuable services and personal bravery in frustrating attempted piracy." In the Order of the Indian Empire, the C.I.E. has been conferred upon three members of the Indian Service of Engineers, namely, Mr. S. Walker, North-West Frontier Province; Mr. J. L. Sale, Delhi; and Mr. W. P. Roberts, Madras.

Agricultural and General Engineers.

AT the tenth ordinary general meeting of Agricultural and General Engineers Ltd., held in London on December 31st, the chairman, Mr. G. E. Rowland, was in the happy position of being able to tell the shareholders that the company had recovered from the setback which had followed the lock-out in the coal industry in 1926. Eleven of the subsidiary companies had, he stated, made an aggregate profit of £235,596, and two of them showed losses totalling £19,838. In neither of the cases in which a loss was shown was the loss a manufacturing one. In one instance it was a result of the Board's decision to cease manufacturing at Thetford, to transfer the products to another works, and to write down the goods so transferred to a very low figure. In the other instance the loss was produced by the necessity of writing down substantially to scrap value a stock of certain products which were no longer being manufactured. The subsidiary companies' properties and plant had been revalued during the year, the chairman continued, and the valuers had certified that at to-day's figures they were worth £730,000 more than the values at which they stood in the companies' books. Independently of that sum, the group's assets showed a surplus of £2,477,492 over its liabilities. Referring to the arrangement—referred to in our columns in our issue of November 22nd—which had been entered into with the Ruston Tractor Company, of Walthamstow, and the H. V. McKay Proprietary, Ltd., of Melbourne, Mr. Rowland said that the tractors would be made at Walthamstow, and the harvesters in Australia or in this country, as might be advisable. The step had not been taken against any foreign group, but represented a justifiable and determined attempt to obtain for the British Empire a much larger share of the agricultural machinery trade of the world than the 7 to 8 per cent. which it now transacted.

K

Locomotives of 1929.

THE honour of producing the most interesting steam locomotive of the year goes to Mr. H. N. Gresley. In this engine a new attempt has been made to evolve a type of water-tube boiler suitable for the peculiar condition of railway service. This boiler was designed by Mr. Harold Yarrow and Mr. Gresley in collaboration, and it has been patented in their joint names. It was constructed at Scotstoun, and is somewhat Yarrow-like, but the tubes stand almost upright and it is divided longitudinally into two sections, the first forming the fire-box, whilst the second takes the place of the conventional barrel. A single steam drum, 36in. in diameter, rolled from the solid by John Brown and Co., Ltd., runs from the back plate up to the smoke-box, but there are four lower drums, also rolled from the solid, two for the fire-box, 18in. in diameter, and two for the "barrel," 19in. in diameter. The steam drum is supported by, and firmly attached to, a cast steel bracket at the forward end, but is allowed freedom to move at the back end where it is supported by a transverse plate. The four lower drums are hung from the steam drum by the tubes and are only constrained sideways. This arrangement permits the boiler to expand and contract freely. The working pressure is 450 lb.

The grate, some 40 square feet in area, is of the conventional form, but with slight inclination, and is fired by hand. The hot gases pass between the tubes into wing chambers and straight forward over a superheater which projects into the interior of the forward part of the boiler. The wing chambers are formed by steel plates unprotected in any way, but surrounded by an outer covering which leaves a space 2in. to 4in. wide. Air is taken into this space at the forward end of the engine, is heated by the plates to some 400 deg. Fah., and enters under the fire-bars through a back damper. A forward damper, taking air in the usual way, is also provided, but in order to get the most economical results, hot air will normally be used.

Water-tube boilers are generally fed with pure water from the hot well of a condenser. That is not possible with a non-condensing locomotive, and provision had to be made against the possible incrustation of the tubes. Mr. Gresley has adopted the following plan. At 3ft. 6in. from the front end a semi-circular weir is fixed inside the drum. All the feed is delivered into the compartment so formed, and has to pass over the weir before getting access to the tubes. It is hoped that all deposition will take place in this compartment from which it can be readily blown out. To make assurance doubly sure the feed is delivered through an injector feed-water heater designed by Mr. Gresley, and made by Gresham and Craven, Ltd. It raises the temperature to about 420 deg. Fah. There are, of course, mud holes in the bottom drums, which can be opened from time to time for the removal of any sludge which may collect in them.

The peculiar appearance of the engine is, in part, due to the absence of any running boards, and in part to the fact that the chimney is completely hidden. The top of the boiler is carried up to the limit allowed by the gauge, and the chimney cannot, therefore, project above it. It is concealed, except in the forward view, by two wings formed by the extension of the smoke-box. The object of these wings is to produce an upward current of air to carry the smoke and steam above the cab windows. The form was arrived at after Professor W. E. Dalby had carried out experiments on a wooden model in the wind tunnel at the Imperial College. A fairly good idea of the construction may be obtained from the photograph of the smoke-box end, which is reproduced in Fig. 1.

The engine is a four-cylinder compound with the high-pressure cylinders inside. The diameters are 12in. and 20in. by 26in. The high-pressure cylinders drive the leading coupled axle, and as the space is very limited, and large bearings were necessary, Mr. Gresley has designed an ingenious pair of cranks with but a single central web. This web takes the form of a plate wide enough to accommodate two crank pins, one on each side at 90 deg. to each other, and extends backwards to form a balance weight. The outside cylinders are fitted with Walschaerts valve gear from which the inside valve is operated through rockers. In the lower half of the rockers die blocks can slide so that the cut-off for the high-pressure cylinders may be varied independently of the low. The controls for the valve gear are operated by oil telemotors supplied by MacTaggart, Scott and Co., Ltd., of Edinburgh; the cylinder cocks are also controlled by telemotors, which are also used for the operation of a dial on the back end which shows the cut-off in the high-pressure and low-pressure cylinders.

For the auxiliary services such as steam heating, vacuum ejectors, injectors, whistle, &c., low-pressure —200 lb.—steam is used. It is drawn from a manifold, which can be seen in our view of the cab, fed through a reducing valve made by A. Cockburn and Co., of Glasgow. A safety valve, set to 200 lb., prevents an excessive rise of pressure in this manifold.

When starting, high-pressure steam is allowed to enter the low-pressure receiver from a 1in. regulator valve. Directly the engine gets away this regulator is shut.

The driving wheels are 6ft. 8in. in diameter, and the connecting-rods, coupling-rods, pistons and general motion of the low-pressure cylinders are the same as those of Mr. Gresley's "Pacifics." The four wheels at the back end are not on a bogie. The forward pair is carried in Cartozzi boxes, whilst the rear pair is on a Bissel truck.

We devote one page of one of to-day's Supplements to two views of this very notable engine. There is no denying that the appearance is so out of the common that at first it is hard to appreciate it, but it has the merit of a smooth, stream-line exterior which may have the effect of reducing air resistance.

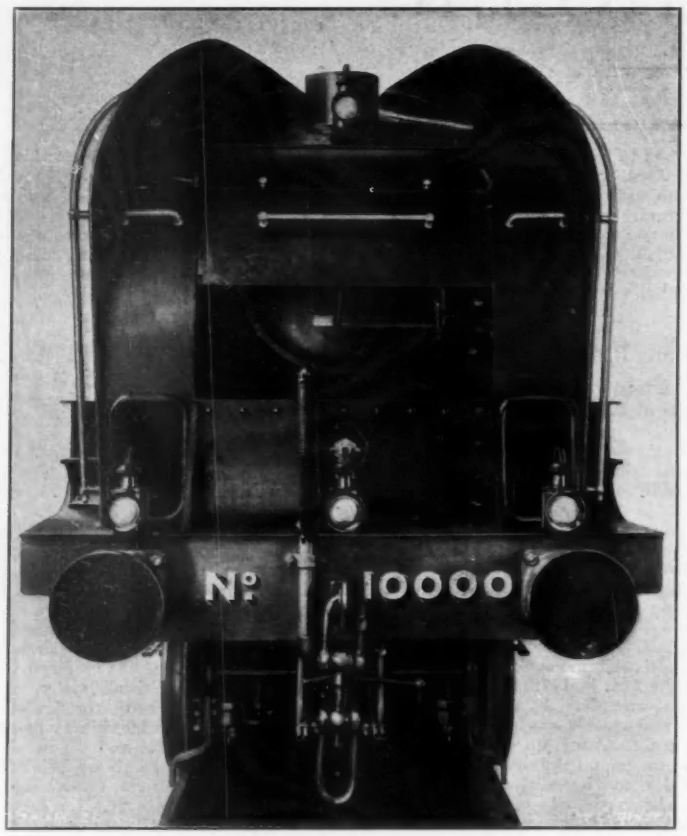


FIG. 1—L.N.E. RAILWAY—FRONT END OF HIGH PRESSURE LOCOMOTIVE

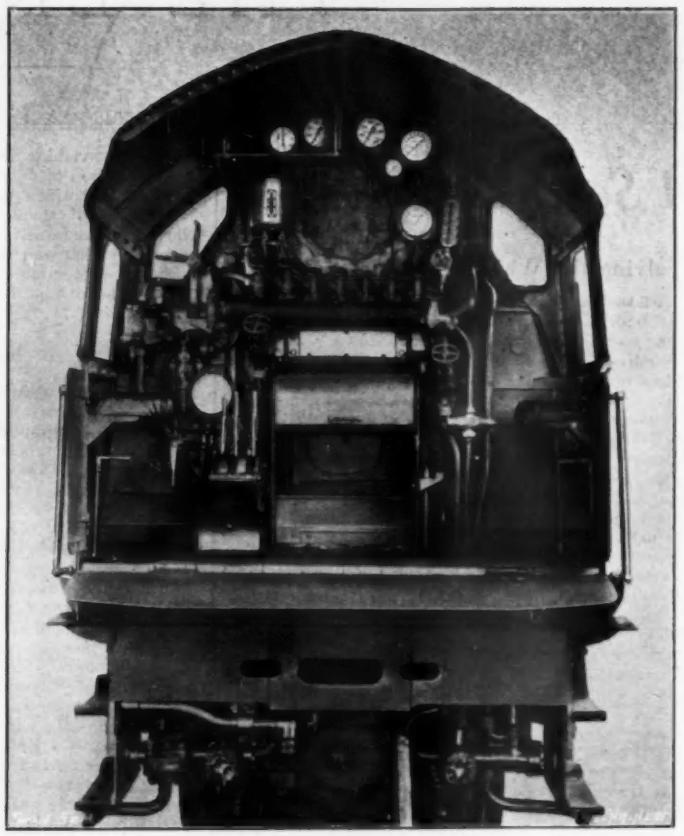


FIG. 2—L.N.E. RAILWAY—CAB OF HIGH PRESSURE LOCOMOTIVE

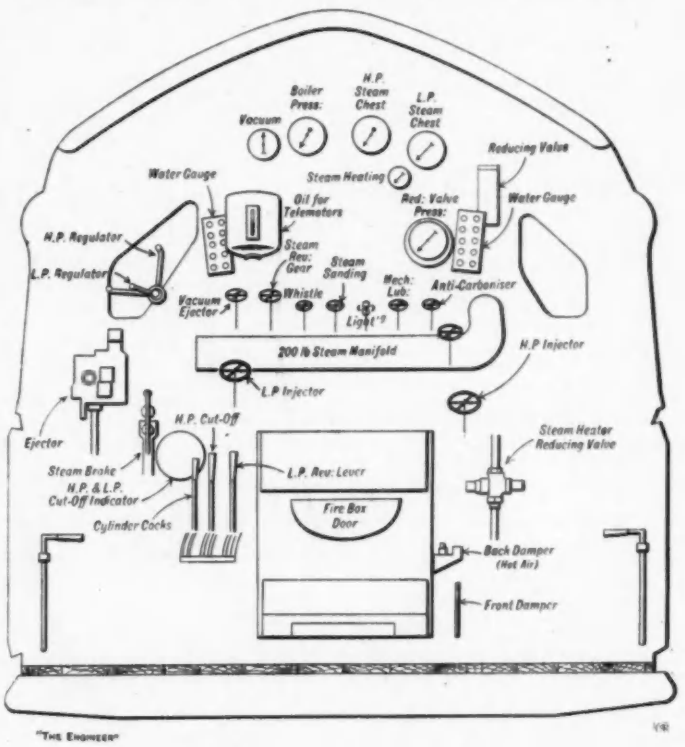


FIG. 3—L.N.E. RAILWAY—KEY TO FIG. 2

Fig. 4 is a weight diagram. With the view of the cab—Fig. 2—we give a key diagram—Fig. 3—which describes the functions of the controls and dials on the back plate.

In a later issue we hope to be able to give complete details of an engine which may solve the long-standing problem of the high-pressure locomotive. By contrast with other designs, it has the great merit—particularly in a locomotive—of simplicity, and, above all, it is British throughout.

It was built at the Darlington works of the Company.

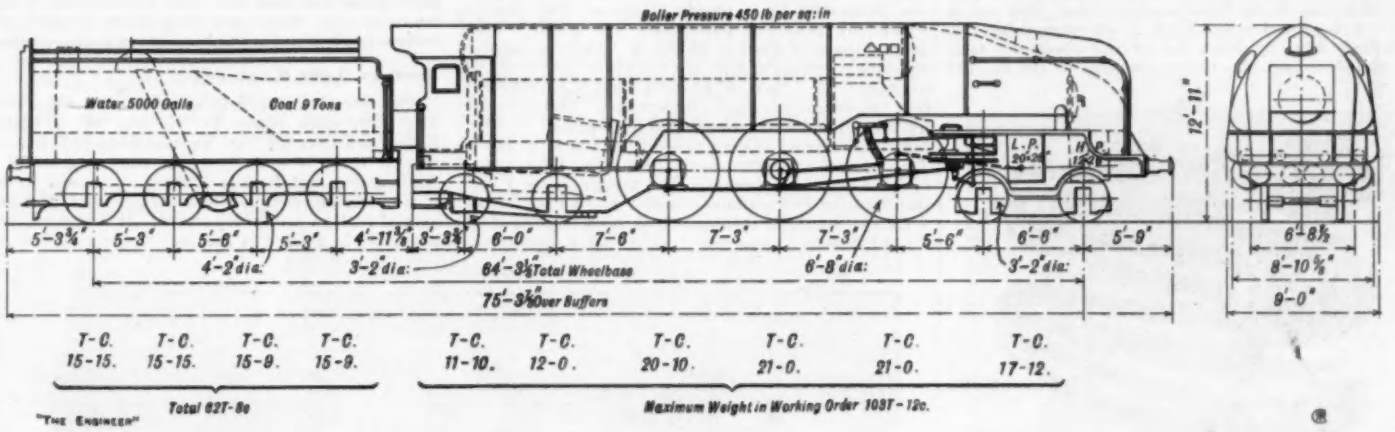

Boiler Pressure 450 lb per sq: in
Water 5000 Galls
Coal 9 Tons
12'-11"
5'-3¾" 5'-3" 5'-6" 5'-3" 4'-11⅝" 3'-3½" 6'-0" 7'-6" 7'-3" 7'-3" 5'-6" 6'-6" 5'-9"
4'-2" dia: 3'-2" dia: 64'-3½" Total Wheelbase 6'-8" dia: 3'-2" dia:
75'-3½" Over Buffers
6'-8½"
8'-10⅝"
9'-0"
T-C. 15-15. T-C. 15-15. T-C. 15-9. T-C. 15-9.
T-C. 11-10. T-C. 12-0. T-C. 20-10. T-C. 21-0. T-C. 21-0. T-C. 17-12.
Total 627-0c
Maximum Weight in Working Order 1037-12c.
"THE ENGINEER"

FIG. 4—L.N.E. RAILWAY—COMPOUND HIGH PRESSURE LOCOMOTIVE

Kitson-Still Locomotive.

We may fittingly refer here to another locomotive, also wholly British in design and construction, which has continued to excite interest throughout the year, and which, through the courtesy of Mr. Gresley, has been well tested in service on the London and North-Eastern Railway. It is the Kitson-Still locomotive, built by Kitson and Co., Ltd., of Leeds, and already fully described in our columns—see particularly our issues of April 15th and 22nd, 1927, and May 4th, 1928. In the last of these articles, an account was given of runs over the very difficult route between Leeds and Wakefield, which includes gradients up to as much as 1 in 73. The engine made frequent stops at stations, and altogether was required to perform a service for which it was not primarily designed.

Since then tests have been made with a dynamometer car on the road between Darlington and Starbeck—39 miles, of which the first 28 are undulating with moderate gradients, and the remainder all up, with the first 3 at 1 in 133, followed by 2 at 1 in 357. The trials were divided into two series. The first with goods trains weighing 390 tons and 441 tons behind the engine, and the second with passenger trains weighing 406 tons and 382 tons, and the average schedule speed was 31 miles per hour. In this connection, we may remind our readers that the locomotive was designed for a full speed of 40 miles per hour.

These trials, especially the first, brought out several interesting points and indicated directions in which the engine could be improved. Certain modifications were, therefore, made, with the result that the consumption in the oil cylinders was greatly reduced; it now stands at approximately 0·8 lb. per draw-bar horse-power per hour.

In the course of these trials a characteristic but unpremeditated test occurred. When the train of 390 tons was climbing the bank of 1 in 133, driving as to 80 per cent. of its D.B.H.P. by internal combustion, it was brought to a stand by a plate-laying signal, and it had, in consequence, to start against the hill, and on a curve. Steam was applied and it got away at once, firing in the internal combustion cylinders beginning when a speed of 7 m.p.h. had been reached. Eventually the summit was passed at 25 m.p.h.

Altogether the tests indicate that marked improvements have been made in the engine, and it has now reached a state at which it is quite a reasonable proposition for countries which have to face difficulties with the supply of feed water. We may add that since it first took the road, the engine has not been opened out, a fact which corroborates the views we expressed upon the quality of the engineering shown in its design and construction. It has now returned to Leeds for a complete examination.

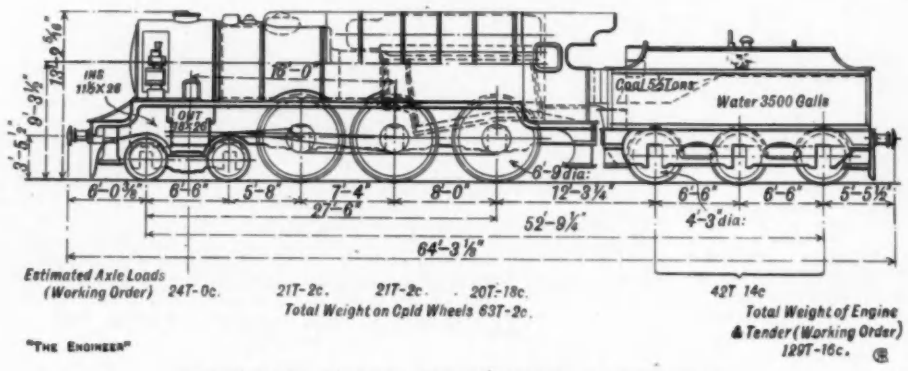


FIG. 5—L.M.S. RAILWAY—DOUBLE PRESSURE LOCOMOTIVE

The only other exceptional engine of the year, as far as Great Britain is concerned, is the "Fury"—see Supplement and Fig. 5—a two-stage high-pressure locomotive built by the North British Locomotive Company, Ltd., for the London, Midland and Scottish Railway and the Superheater Company, Ltd., this firm being responsible for the design and construction of the boiler. The special feature is the boiler, which in principle is precisely the same as that of the experimental engine built by Henschel and Sohn, and fully described in our issue of January 20th, 1928.

This engine is designed to work in the same link as the "Royal Scots," and the frames are the same, but the engine is a three-cylinder compound with the high-pressure cylinder inside, instead of a three-cylinder simple. The cylinders are 11½in. and 18in. by 26in. Compounding is an essential feature of the Schmidt system. The high-pressure steam, at about 900 lb., is admitted to the high-pressure cylinder and exhausts into a receiver in which it is augmented by steam at 250 lb. and so passes to the low-pressure cylinders.

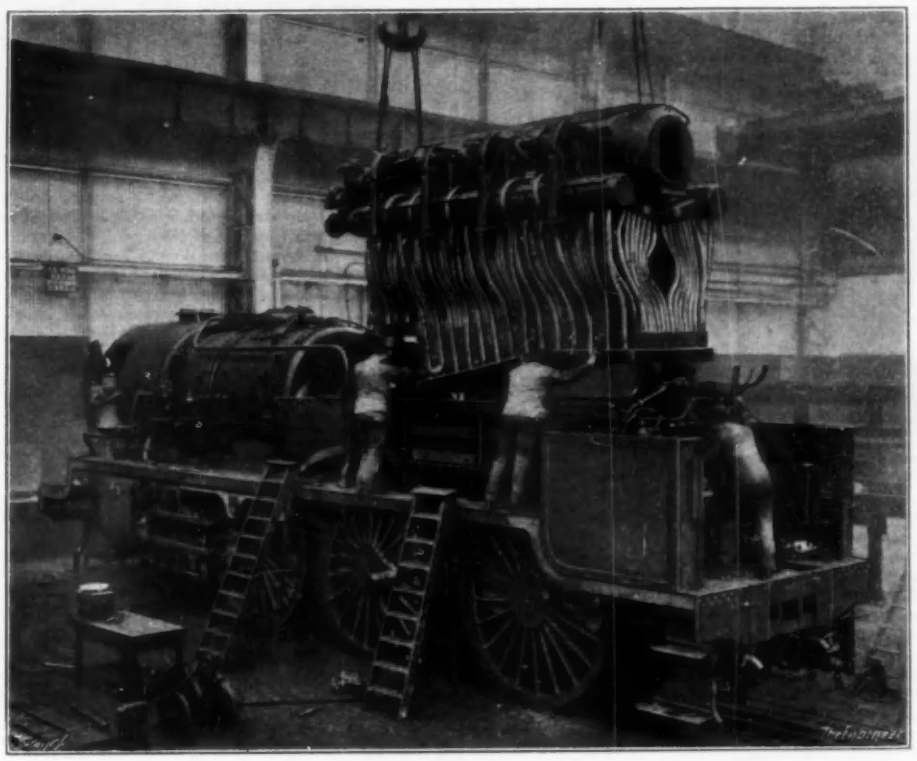


FIG. 6—L.M.S. RAILWAY—ERECTING DOUBLE PRESSURE LOCOMOTIVE

The boiler consists of three essential parts. First, a tubular fire-box, seen well in one of the views which we reproduce to-day—Fig. 6—in which the circuit is practically closed. Here steam is generated at anything between 1400 lb. and 1800 lb. pressure. This steam circulates through coils—see Fig. 7—mounted in the high-pressure steam drum. These coils evaporate water in the drum at about 900 lb. pressure. The third part is a more or less normal locomotive barrel with the usual tubes, through which the hot gases pass to the smoke-box. In this part the pressure is 250 lb. The high-pressure drum—see Fig. 8—is of nickel steel and is not in contact with the fire. It is fed by water from the low-pressure boiler, in which purification takes place as usual. The barrel of this boiler is also of nickel steel, but it has mild steel tube plates.

The steam pressure rises more rapidly in the high-pressure drum than in the low-pressure boiler, but the excess steam is passed from the former into the latter, and in that way the blowing off of high-pressure steam is avoided. Two superheaters are included in the design, one for the high and the other for the low pressure.

A full description of this engine will appear in a later issue.

An engine which, although it does not present any radically novel characteristic, deserves to be given

special mention on account of its size, is a Beyer-Garratt, designed and built by Beyer, Peacock and Co., Manchester, for the South African Railways. The original order was for two engines, but on delivery they proved so successful that six more were ordered during the year. As will be seen from the view reproduced in one of our Supplements to-day, they are of the 4–4–2—2–4–4 type. Each of the engines has two cylinders, 22in. by 26in., the driving wheels are 48in. in diameter and the boiler pressure is 200 lb. At

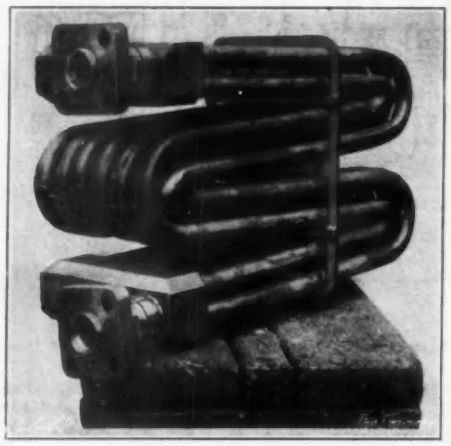


FIG. 7—HIGH PRESSURE COILS

75 per cent. of this pressure the tractve effort is 78,650 lb. and at 90 per cent. it is 94,300 lb. The gauge is 3ft. 6in. and the maximum axle load 18½ tons. The total wheel base is 83ft. 7in. and the wheel base of each unit 27ft. 8in., with a rigid base of 9ft. The boiler has a total evaporative surface of 3376 square feet, and a superheater surface of 809 square feet. The grate area is 74½ square feet. Seven thousand gallons of water and 12 tons of coal can be carried. The total weight of this great engine is 214 tons 2 cwt.

FIG. 8—STEAM DRUM

and the adhesive weight 147 tons 8 cwt., both in working order.

We have to look abroad for another remarkable engine. It is a 1200 H.P. compressed air Diesel locomotive built by the M.A.N. in conjunction with the Maschinenfabrik Esslingen and now being tried on the German State Railways. In principle it departs from common practice, for compressed air is employed as the medium of transmission. The Diesel engine in this case drives an air compressor; the compressed air is heated by the exhaust of the Diesel engine and enters ordinary locomotive cylinders. The engine is illustrated in one of our Supplements to-day. We are informed that on trial in November last the locomotive pulled a train weighing 233 tons up to the Geislinger Steige, gradient 1 in 40, and mostly on curves, at a speed of 12 miles per hour.

Companies' Engines.

Apart from the locomotives for the L.N.E.R. and the M.R., to which we have already referred, the companies have little or nothing new to show, though a good number of new engines of existing types has been built. On the L.M.S. Railway, for example, 225 engines were put into traffic during the year, of which all but thirty-one were built at Derby, Crewe and Horwich; but the only new type is an 0–8–0 goods, of which one hundred were built at Crewe. These engines are illustrated by a weight diagram—Fig. 8A—on which the principal particulars are given. They exert a tractive effort of 28,250 lb. at 85 per cent. of the boiler pressure, and are similar in power to the existing "G2" class of the old L. and N.W. Railway, but the design has been modernised. The cylinders have been reduced from 20½in. in diameter to 19in., but the pressure has been raised from 180 lb. to 200 lb. The old stroke was 24in. and is now 26in. The original boiler has been retained. The tender is an L.M.S. standard for 3500 gallons of water and 4 tons of coal.

On the Southern Railway three more engines of the "Lord Nelson" class were built at Eastleigh Works,

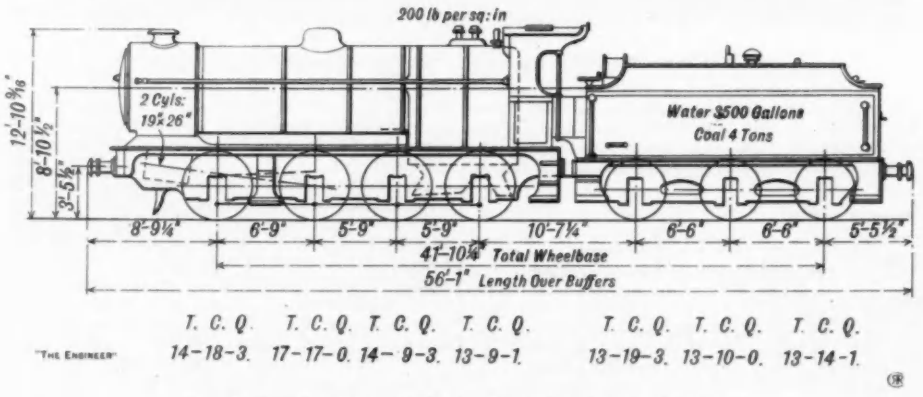


FIG. 9—L.M.S. RAILWAY—EIGHT-COUPLED GOODS ENGINE

This total includes fifty of the 0–6–0T "5700" class built by the North British Locomotive Company, Glasgow, and delivered early in the year. One hundred more of these engines are being built out to contract, twenty-five each by Bagnall, Ltd., Stafford; Kerr, Stuart and Co., Stoke; North British Locomotive Company, Glasgow; and the Yorkshire Engine Company, Sheffield; whilst twenty more are also under construction at Swindon Works. Seventy of the "Hall" class are now in service and ten under construction. The new "5101" class is intended for heavy suburban traffic. Heavy repairs to 1080 engines were carried out during the year at the various workshops under the company's management.

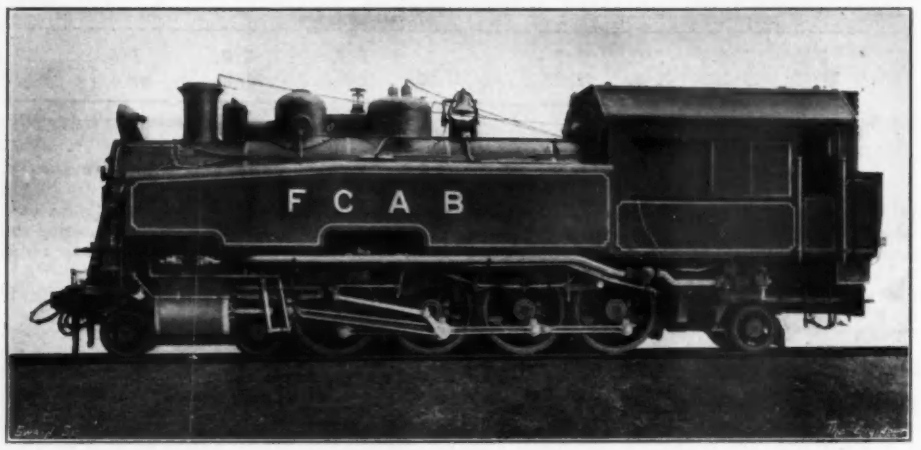


FIG. 10—ANTOFAGASTA-BOLIVIA RAILWAY—METRE GAUGE LOCOMOTIVE—HAWTHORN

completing an order for ten, and a further order for five has since been completed, making a total of eight and bringing the number of these engines in service to sixteen. The Brighton Works built eight three-cylinder shunting tank engines of the 0–8–0 type, while Ashford Works completed the remaining eight of an order for ten 2–6–0 type passenger engines with 6ft. diameter driving wheels. An order for ten more of these two-cylinder engines has been placed at Ashford, and twenty of the same type will be built at Eastleigh with three cylinders.

Work in hand includes five three-cylinder goods engines of the 2–6–0 type with 5ft. 6in. diameter driving wheels, being built at Ashford, while Eastleigh is beginning to build ten three-cylinder 4–4–0 type engines to be known as the "Schools" class. Another new design in hand at Eastleigh is that of a three-cylinder goods tank engine of the 2–6–4 type with 5ft. 6in. diameter driving wheels, of which ten will be put in hand.

During the year the Great Western Railway put 159 new locomotives into service, including sixty-five 4–6–0 "Hall" class, two cylinders, passenger type; ten 2–6–2T mixed traffic outside cylinders, "5101" class; four 2–6–2T mixed traffic outside cylinders, "5500" class; eighty 0–6–0T goods, "5700" class.

SOME MAKERS' ENGINES.

We are informed by makers that the business in new locomotives of the industrial class was poor throughout the year, but that a great deal of repair work came in. There are, nevertheless, several rather interesting engines of various classes to put on record.

Hawthorn, Leslie & Co., Ltd.

Two interesting engines are shown by Figs. 10 and 11. Both were made by R. and W. Hawthorn, Leslie and Co., Ld., at Newcastle-upon-Tyne. The first of these is a metre-gauge tank engine for the Antofagasta and Bolivia Railway. As will be seen, it is extremely compact and complicated, and many special fittings are incorporated. It burns oil, which is carried in a tank in the roof of the cab, but rapid conversion for coal-firing is possible. It has vanadium carbon steel coupling and connecting-rods, and amongst its other accessories is a Stone's electric lighting equipment and a steam-operated alarm bell. The cylinders are 21in. by 24in. and the wheel 4ft. 3in. in diameter, the gauge is 1 m. and the weight, in working order, 86 tons.

The other engine by Hawthorn's—Fig. 11—is of interest because it is believed to be the largest fireless locomotive built in this country. It has 20in. by 18in. cylinders, driving 3ft. 0½in. wheels, and weighs 36 tons in working order. The charging pressure is 275 lb. and the reservoir pressure 200 lb., which is reduced by valves to 90 lb. It was constructed for use in the Slacks Valley Power Station of the

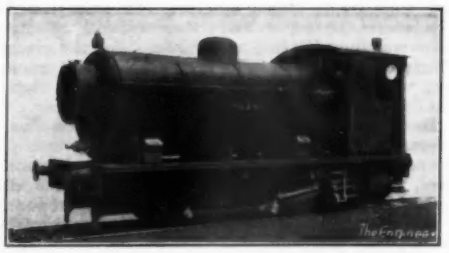


FIG. 11—FIRELESS LOCOMOTIVE—HAWTHORN

County Borough of Oldham, where, of course, there is no fire risk. It is the simplicity and low maintenance costs which led to its adoption for such a service.

Beyer, Peacock & Co., Ltd.

We have already referred to the huge "Beyer-Garratt" engines built by Beyer, Peacock and Co., Ltd., for the South African Railways, one of which is illustrated in one of our Supplements. We notice from a return sent to us by the company that it was engaged during the year upon more of this type than of normal designs, most of them of large size, the smallest, for the Guayaquil and Quibo Railway (3ft. 6in. gauge), weighing 120½ tons, whilst another, for the Buenos Ayres and Pacific Railway (5ft. 6in. gauge) weighs 191½ tons, not very far short of the weight of the huge machines for the South African Railways, which turn the scale at 214 tons 2 cwt. For the Buenos Ayres and Pacific the company constructed ten "Mikado"—2–8–2—engines of normal design with 24½in. by 30in. cylinders, weighing, with double boiler tender, 205 tons.

Sir W. G. Armstrong & Co., Ltd.

The Scotswood works of Sir W. G. Armstrong, Whitworth and Co. (Engineers), Ltd., have been kept fairly busy during the year on the construction of complete locomotives and locomotive boilers. From the engines we have selected for illustration

in a Supplement a broad gauge 2–8–2 locomotive, with double bogie tender, of which eleven have been completed for the Madras and Southern Mahratta Railway—5ft. 6in. gauge. These engines have two outside cylinders, 22½in. by 28in., driving 5ft. 1½in. coupled wheels with a boiler working pressure of 180 lb., giving at 85 per cent. a tractive effort of 35,260 lb. The total heating surface is 2176 square feet, the superheater area is 540 square feet, and the grate area 45 square feet. In working order the engine weighs a little under 96 tons, and the tender about 64½ tons. Amongst other locomotives of various types and sizes the firm constructed two

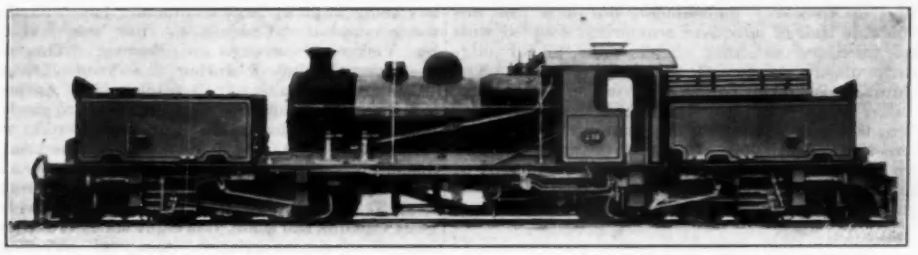


FIG. 12—GARRATT LOCOMOTIVE FOR BRAZIL—ARMSTRONGS

"Garratt's" with the 2–6–2+2–6–2 wheel arrangement for the Great Western Railway of Brazil—metre gauge. A photograph of one of these engines is reproduced in Fig. 12. They have two cylinders, 14½in. by 20in., for each engine, and the working pressure is 200 lb. With 3ft. 6in. driving wheels there are two speeds, namely, 3 m.p.h. and 6 m.p.h. in either direction. A heavy roller-chain drive is employed. In low gear the locomotive exerts a tractive effort of 3940 lb., and in high gear 1970 lb. It weighs 9½ tons.

Vulcan Foundry, Ltd.

The bulk of the work carried out by the Vulcan Foundry, Ltd., Newton-le-Willows, was the construction of "Standard" engines of various sizes and gauges for the Indian State Railways, but the firm also made the mechanical parts for thirty-one electric goods locomotives for the Great Indian Peninsular Railway. These are really big engines, capable of exerting a tractive effort of 67,200 lb. at starting and maintaining a pull of 40,000 lb. at 20½ m.p.h. They weigh 123 tons each. The drive is of the jack-shaft and simple connecting-rod type, the tractive effort is 32,900 lb. at 85 per cent. of the working pressure. The weight in working order is approximately 96 tons.

Avonside Engine Co., Ltd.

We illustrate two locomotives of small size built by the Avonside Engine Company, Ltd., of Bristol. The first—Fig. 13—has six coupled wheels, 2ft. in diameter, on a base of no more than 4ft. 6in. The purchasers insisted upon Stephenson valve gear, which, owing to the proximity of the axles, had to be put outside. The cylinders are 8½in. by 12in., and the boiler pressure is 160 lb. At 80 per cent. of it the engine develops a tractive effort of 4624 lb., and it weighs, in working order, 11½ tons. The other Avonside locomotive which we illustrate—Fig. 14—is propelled by a four-cylinder petrol engine developing 45 B.H.P. at 1000 r.p.m. and 57 B.H.P. at 1600 r.p.m. The gauge is 5ft. 3in. with a gear ratio of 1 to 4·15. The wheel arrangement is 0–6–0+0–6–0, and current is collected from an overhead wire.

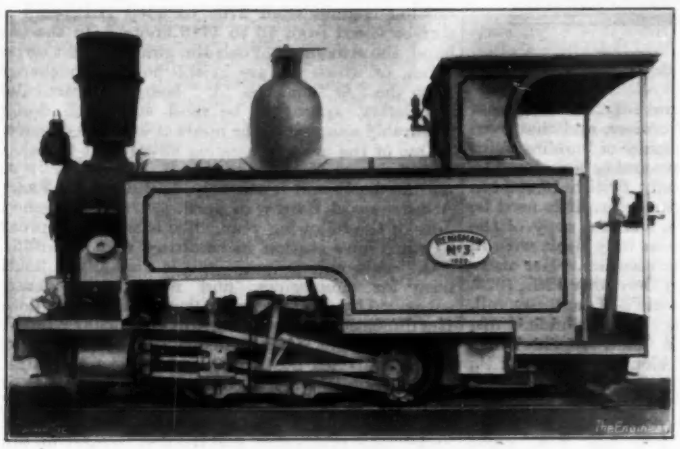


FIG. 13—TANK ENGINE—AVONSIDE

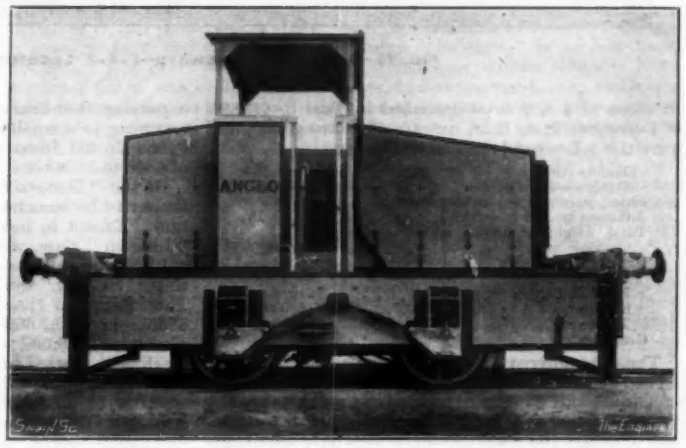


FIG. 14—PETROL LOCOMOTIVE—AVONSIDE

W. G. Bagnall, Ltd.

W. G. Bagnall, Ltd., of Stafford, built, amongst a fair number of other engines of various sizes, three saddle tank shunting engines for the Peruvian Corporation Ltd.—see Fig. 15. They have bar frames, steel fire-boxes and burn oil. The cylinders are 18½in. by 24in., the wheels 4ft. diameter, and the wheel base 9ft. One ton of fuel oil and 1000 gallons of water are carried. The total weight in working order is 51 tons.

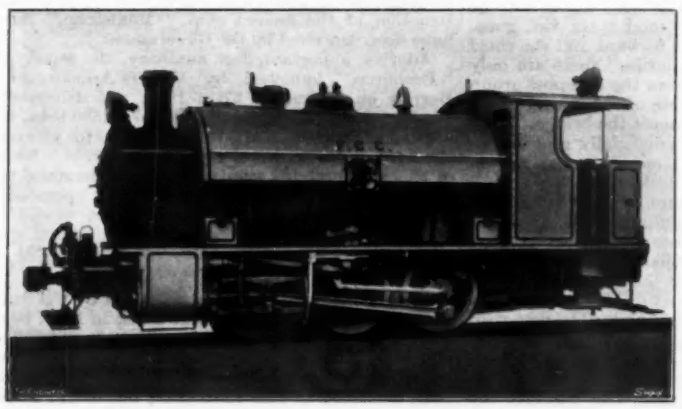


FIG. 15—SADDLE TANK ENGINE—BAGNALL

Hudswell, Clarke & Co., Ltd.

The engine illustrated by Fig. 16 was built by Hudswell, Clarke and Co., Ltd., to the order of the Peruvian Corporation for the Pacasmayo Railway. It has cylinders 13in. by 21in., wheels 3ft. 3½in. and a wheel base of 6ft. 6in. The gauge is 4ft. 8½in. The weight of the engine, empty, is 15½ tons, and it carries 300 gallons of water and has 30 cubic feet capacity for fuel. The battery electric locomotives—Fig. 17—also made by Hudswell, Clarke and Co., Ltd., are of interest, as several of them are being employed on the great Mersey Tunnel contract. The gauge is 2ft., and two 4½ B.H.P. motors are carried, one for each axle. Worm reduction gear is used. The batteries are lifted off for re-charging.

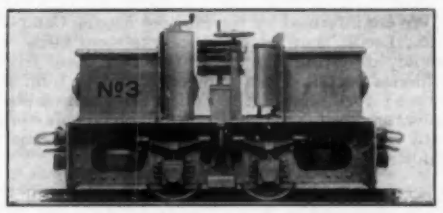


FIG. 17—BATTERY LOCOMOTIVE—HUDSWELL, CLARKE

Kitson & Co., Ltd.

We have spoken already of the encouraging results attained during the year by the Kitson-Still engine built by Kitson and Co., Ltd., of Leeds. Amongst other interesting engines built by the firm is a Kitson-Meyer for the Cundinamarca Railway, which is also designed that the gauge may be increased from the present 3ft. to 3ft. 3¾in.—by fitting new tires, brake cross beams, and hangers—when a contemplated

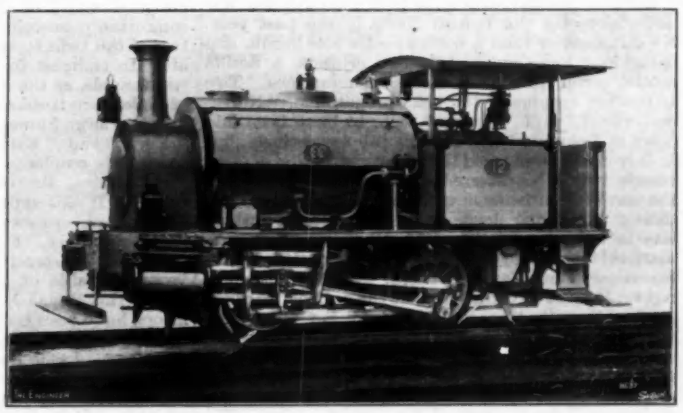


FIG. 16—SADDLE TANK ENGINE—HUDSWELL, CLARKE

alteration is made in the line. This engine is mounted on bar frames and weighs 96 tons. It will round a curve of 80 m., and can develop 40,000 lb. tractive effort at 85 per cent. of the boiler pressure, which is 190 lb. The company made also four shunting tank engines with bar frames for the San Paulo Railway, Brazil. They weigh nearly 66 tons, and have large side tanks. The wheel arrangement is 0–6–2.

North British Locomotive Co., Ltd.

The most interesting engines completed by the North British Locomotive Company, Ltd., Glasgow, during the year were the Schmidt two-pressure engine for the L.M.S., to which we have already referred at some length, and a very fine De Glehn compound for the Bengal-Nagpur Railway, which was fully described and illustrated in our issue of September 13th, 1929. It has two 16½in. high-pressure and two 25in. low-pressure cylinders, all with a stroke of 26in., and a working pressure of

250 lb. is used. Some three-cylinder engines for the Federated Malay States were also completed. The cylinders are 17in. by 24in., and the pressure is 180 lb. The tractive effort at 75 per cent. of the boiler pressure is 26,000 lb., and the weight 69 tons 3 cwt. Double-bogie tenders weighing 39 tons 6 cwt. accompany the engines.

Hunslet Engine Co., Ltd.

We are informed by the Hunslet Engine Company, Ltd., Leeds, that whilst its works were fairly well employed during the year, the bad state of the collieries curtailed the number of orders from that source; furthermore, the Indian Government placed orders amounting to nearly one million pounds sterling with continental firms, and the British locomotive industry suffered in consequence.

Colombian Railways.

During the year some further three-cylinder narrow-gauge main line locomotives of Mr. Dewhurst's patented design, but larger, and of the 4–8–2 type, have been constructed in Germany for the Government railways of Colombia, South America—Fig. 18. These engines have similar characteristics

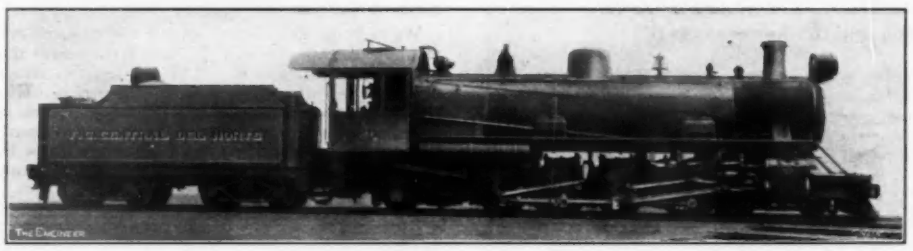


FIG. 18—COLOMBIAN RAILWAYS—4-8-2 LOCOMOTIVE

to those of 4–6–2 type described in THE ENGINEER of December 21st, 1928, but are of metre gauge, and have the following principal dimensions :—

Cylinders (three)	17in. × 21in.
Driving wheels, diameter	3ft. 10in.
Rated tractive force at 85 per cent.	30,279 lb.
Adhesion weight in working order	106,500 lb.
Total weight of engine and tender in working order	99 tons
Heating surface—	
Fire-box	149·4 sq. ft.
Flues and tubes	1540·6 sq. ft.
Superheater	415·0 sq. ft.
Total	2105·0 sq. ft.
Grate area	37·4 sq. ft.

The locomotives are for heavy passenger service on the Central Northern Railway, which has gradients of 1 in 33 and 4-chain curves on the main line. The first and third coupled wheels are flangeless in some, and in others the main driving wheels only are flangeless. The typical outside main framing associated with Mr. Dewhurst's designs can be clearly observed in the reproduction. The valve for the inside cylinder is operated through a separate set of gear from a return crank on the rear coupled crank pin on the right side of the engine. The engines so far constructed will burn coal, but the fire-box is designed also for burning fuel oil.

Naval Construction in 1929.

Great Britain.

ONLY a meagre amount of new construction was undertaken for the British Navy in the past year. No ship heavier than a flotilla leader was begun, and launchings were confined to two cruisers, a flotilla leader, seven destroyers, and six submarines. Two 10,000-ton cruisers of the 1928 programme, "Northumberland" and "Surrey," were to have been laid down at Devonport and Portsmouth respectively, but in July it was announced that the construction of these vessels would be deferred, pending the outcome of the naval disarmament negotiations. At the same time a submarine depôt ship, "Maidstone," which was to have been built at Chatham, and two submarines for which contracts had been placed with Beardmores and Cammell Laird, were cancelled outright. It must be confessed that the outlook for naval shipbuilding in this country is by no means encouraging. Unless the Five-Power Conference which is to meet in London on January 21st proves a complete failure—which is, to say the least, unlikely—the chances are that no new capital ships or heavy cruisers will be in demand for years to come. The postponement of battleship replacement until 1936, instead of to the year 1931 specified in the Washington Treaty, is generally accepted as assured. It is significant that neither Great Britain nor Japan, nor even the opulent United States, shows any eagerness to resume the building of 35,000-ton ships at a cost of about £8,000,000 per ship. As for the 10,000-ton cruiser, this type has declined in favour everywhere save in America. In spite of its imposing size, speed, and armament, it is dangerously wanting in protection, and may be said to repeat, in an aggravated form, the worst defects of our pre-war battle-cruisers. It has the further drawback of being inordinately expensive. Treaties or no treaties, the British Empire will always, within the range of human calculation, need an abundance of cruising ships, but we cannot afford to build numerous ships at a cost of £2,000,000 per keel. We should not be surprised if the "Dorsetshire," which was launched on January 29th, 1929, proved to be the last 10,000-ton cruiser built for the British Navy. Including the two Australian units, we now have thirteen of these vessels afloat. They are handsome and, within limits, efficient ships, the design of which does credit to the Admiralty constructors. They can do everything but stand up to heavy punishment, but it is this unavoidable lack of adequate armouring, coupled with their excessive cost, that renders them, in our judgment, unsuitable for British requirements. The Admiralty is known to have in view a new type of cruiser, displacing by "standard" measurement about 6000 tons, mounting 6in. guns, and costing not more than £1,200,000. If the Government's tentative proposals for cruiser limitation are endorsed at the forthcoming Conference, all, or nearly all, our future cruisers will be of this type. We would observe, in passing, that France, Italy, and Japan show signs of reverting to a smaller type of cruiser, and that even in the United States the expediency of building ships of 6000 to 7000 tons is being favourably considered.

Of the "Dorsetshire," the only British 10,000-ton cruiser to be launched in the past year, little need be said. Except in minor details, she is a copy of the "London" class, which has been fully dealt with in our columns on more than one occasion. Her sister ship, "Norfolk," went afloat on December 12th, 1928. Their principal characteristics are :—Length overall, 633ft.; breadth, 66ft.; draught, 17ft.; standard displacement, 10,000 tons; full load, 13,630 tons; machinery, geared turbines developing 80,000 S.H.P., eight small-tube, oil-burning boilers; the designed speed is 32·25 knots. With all bunkers filled, the steaming radius at economical speed is 10,400 miles. Armament—eight 8in. guns, four 4in. A.A., eight torpedo tubes on quadruple carriages. Protection appears to be limited to a 3in. deck over vitals. Owing to the small margin of weight available, the gun turrets are very lightly built, and could not withstand direct hits. Particulars of sub-surface protection are lacking, but in the "Dorsetshire," as in the "London" group, the external bulge worked into the five "Kents" has been dispensed with.

The "Exeter," launched July 18th, 1929, and the "York," which took the water twelve months earlier, represent a modified type which, but for the new disarmament proposals, would probably have been multiplied. The length is 575ft. overall; breadth, 57ft.; draught, 17ft.; displacement, 8400 tons. Although considerably lighter than the "County" class, they have machinery of equal power, and the designed speed of 32·25 knots will, no doubt, be comfortably exceeded. They mount six 8in. guns, two of the twin turrents being forward and the third aft. In contrast to the "Counties," there are only two funnels, as the uptakes from the foremost group of boilers are trunked with those of the second group into one large funnel set well abaft the bridge. Both "York" and "Exeter" are unofficially reported to carry two seaplanes mounted on catapults, one on "B" turret, the other on deck abaft the second funnel. If this report is accurate, they will be the first British cruisers to be equipped with a pair of flying machines. For the present, no other cruisers are under construction or projected, but to provide vessels capable of performing the police duties for which the Royal Navy is responsible a number of sloops have been built or are in hand. The first pair, "Bridgewater" and "Sandwich," launched by Hawthorn, Leslie and Co. in 1928, are now in commission. They are 266ft. long, 34ft. broad, draw 8½ft., and displace 945 tons. The turbines are of 2000 S.H.P. for a speed of 17 knots. Two 4in. guns are mounted. The living quarters and the ventilation are specially designed with a view to the comfort and health of the crew in tropical waters. The objection to these vessels is their very small tonnage. Six further sloops were begun in 1929, three at Devonport, one at Chatham, and two by Swan, Hunter and Wigham Richardson, Ltd. In these the displacement has been increased to about 1200 tons. Four more vessels of the same class are to be built under the current Navy Estimates.

The flotilla leader "Codrington," the first of her type to be laid down since the war, was launched by Swan, Hunter and Wigham Richardson on August 7th. Length, 332ft.; breadth, 33ft. 9in.; displacement, 1520 tons; geared turbines transmitting 39,000 S.H.P. through two shafts; Yarrow boilers with a working pressure of 300 lb.; contract speed, 35 knots. Armament, five 4·7in. guns, eight torpedo tubes on quadruple mountings. Allowing for the difference between "standard" and "normal" displacement, the "Codrington" is approximately of the same tonnage as our earlier leaders of the "Shakespeare" and "Scott" class. It will be seen that the Admiralty has elected not to follow the example of France, where leaders of 2700 to 3000 tons are being built in large numbers. The "Keith," a sister vessel to "Codrington," has been laid down by Vickers-Armstrongs at Barrow. The seven destroyers launched during the year—"Acasta," "Achates," "Active," "Antelope," "Anthony," "Ardent," and "Arrow"—all at Northern yards, are practically uniform with the Thornycroft vessel "Amazon," completed in 1926. They have the same displacement, viz., 1330 tons, but the dimensions have been slightly modified and the contract speed reduced from 37 to 35 knots. The armament of four 4·7in. guns remains the same, but eight tubes are mounted instead of six as in the "Amazon." The eighth destroyer of this group, "Acheron," building by Thornycrofts, will go afloat in a few weeks. Eight further destroyers, comprising the "B" class, with "Beagle" as nameship, were laid down in pairs during 1929 by John Brown and Co., Hawthorn, Leslie, Palmers, and Swan, Hunter. Of the seven submarines launched in the past year, all save "Orpheus"—February 26th—belong to the "P" or "Parthian" class. They are improved versions of the "O" design, the surface tonnage having been increased from 1540 to 1570 tons, the internal combustion engines from 2700 to 4400 H.P., and the surface speed from 15 to 17·5 knots. On the other hand, the armament of one 4in. gun and eight torpedo tubes, of which six are in the bows, is unchanged. Both the "O" and the "P" boats, but particularly the latter, appear to be most successful designs, admirably adapted to the needs of overseas defence.

One of the most interesting naval craft to be completed during the year is H.M.S. "Medway," a submarine depôt and repair ship, laid down by Vickers-Armstrongs at Barrow in April, 1927, and launched in July of the following year. She is shortly to proceed to the China station in company with a flotilla of "O" class submarines. She is virtually a floating base for submarines, and many novel features suggested by war experience find a place in her design. Her dimensions are :—Length overall, 580ft.; breadth, 85ft.; draught, 23ft.; displacement, 15,000 tons. She is propelled by twin-screw double-acting M.A.N. Diesel engines with an output of 8000 B.H.P., the contract speed being 16 knots. The "Medway" is the first auxiliary ship to be provided with special underwater protection, and the first to carry an armament of six 4in. guns, four of which are on A.A. mountings. She has extensive mooring facilities for submarines lying alongside, including propeller guards and massive floating fenders. In addition to her own fuel oil supply of 530 tons, she can stow in her double bottom 1900 tons of oil for attached submarines. The internal layout of the vessel includes twelve workshops, cold storage chambers of 10,000 cubic feet capacity, and magazines for torpedoes, war-heads and ammunition. The total berthing space is sufficient for 135 officers and 1600 men, every officer being provided with a single-berth cabin. The "Medway" may, therefore, be described as the last word in submarine mother ships. In view of the arduous and trying nature of duty in submarines, more vessels of this type are urgently needed, especially on foreign stations, and it is much to be regretted that the construction of the second ship, "Maidstone," should have been cancelled by the Government.

Another important fleet auxiliary, the repair ship "Resource," launched by Vickers-Armstrongs at Barrow on November 27th, 1928, was delivered in the past year. A turbine steamer of 13,500 tons, with a speed of 15 knots, she is fully equipped for all except the heavier categories of repair work afloat. Details of this ship are still scanty, but we understand that all the auxiliary machinery on board is operated by oil-electric power.

United States.

Five of the eight cruisers authorised by the Act of December 18th, 1924, were put afloat in 1929, beginning with the "Salt Lake City," on January 23rd, and the "Pensacola," on April 25th. These two, which differ materially from the other six, have already been described in THE ENGINEER, but it will be convenient to repeat their main characteristics. Length overall, 585ft. 6in.; breadth, 64ft.; mean draught, 17ft. 5in.; displacement, 10,000 tons; geared turbines of 107,000 S.H.P., four screws, 32·5 knots, White-Forster boilers. Both ships were launched with their main armament on board. This consists of ten 8in. 55-calibre guns in four turrets, disposed as follows :—A two-gun turret on the forecastle deck, with a three-gun turret in rear of it and superposed, and a corresponding arrangement aft. In addition, four 5in. A.A. guns and six torpedo tubes are mounted.

Protection is exiguous, for it does not appear that any armour thicker than 1½in. has been worked into the ship, either vertically or horizontally. American naval experts acknowledge these ships to be overweighted with armament, and in the six later vessels only nine 8in. guns are mounted, in three triple turrets, two forward and one aft. Five more cruisers of the same general type were ordered in 1929, and although three of these vessels have been suspended, in consequence of the disarmament negotiations, it is positively reported that the guns and gun mountings for all five ships are in process of manufacture. The only other naval craft to be launched in 1929 were the submarines "V 5" and "V 6," each of 2760 tons surface displacement, with a speed of 17 knots, and an armament of two 6in. guns and six torpedo tubes. Excepting the French "Surcouf," they are the largest submarines built for any navy to date. The programme of battleship reconstruction is being carried out according to plan. Up to the present the "Utah," "Florida," "Arkansas," "Wyoming," "New York," "Texas," "Oklahoma," and "Nevada" have been modernised, and there are now, or shortly will be, in hand the "Pennsylvania," "Arizona," "New Mexico," "Idaho," and "Mississippi." The work includes bulging, the fitting of extra armour protection, conversion of coal-burning boilers to oil firing, and, in the five last-named ships, increase of turret gun elevation from 16 deg. to 30 deg. or 35 deg. The cost varies from £1,200,000 to £2,000,000 per ship.

Japan.

No large ship was launched in 1929, but four 10,000-ton cruisers were completed, the first of their type to be commissioned for the Japanese Navy. "Nachi," "Myoko," "Ashigara," and "Haguro" are comparable to the American "Salt Lake City" class, in that they carry ten 8in. guns and can steam at 32·5 to 33 knots. They have the characteristic "wave-lined" hull, trunked funnels, and towering bridgework of the earlier but smaller 8in. gun cruisers. Protection is said to be very good, a 4in. belt in conjunction with steel decks and a triple underwater hull, though it is difficult to believe that all these features have been incorporated in a 10,000-ton ship with such heavy armament and high-powered machinery. Four further vessels of the same type are under construction, bearing the names of "Atago," "Takao," "Chokai," and "Maya." Upon the completion of these ships Japan will possess four 7100-ton and eight 10,000-ton cruisers, mounting in all 104 guns of 8in. calibre. The aircraft carriers "Kaga" and "Akagi," rebuilt from capital ship hulls, have both been delivered. They bear a superficial resemblance to H.M.S. "Furious," except in the arrangement of the ducts for discharging furnace smoke and fumes. The "Kaga" has enormous flues, which are carried externally on either side of the ship towards the stern, where they are turned outboard; the "Akagi" has smoke ducts which are simpy huge funnels trunked outward and downward amidships. A much smaller aircraft carrier, the "Ryujo," has been ordered from the Yokohama Dock Company. She will displace only 8100 tons, and is, apparently, to be a reduced copy of the "Hosho." Several destroyers were launched during the year, all belonging to a group of twenty-four craft, "Fubuki" class, authorised in 1926. They are large vessels, 368ft. in length, displacing 1700 tons, with a contract speed of 35 knots, and are armed with six 4·7in. guns and nine tubes. Their most noticeable feature is that their guns are paired in gas-tight light splinter-proof gun-houses, and they are believed to be the first destroyers in which guns have been so mounted. A submarine, "I 60," which was launched at Sasebo on April 24th, is typical of the heavy, fast, ocean-going class which has been recently developed in the Japanese Navy: length, 330ft.; surface displacement, 1650 tons; surface speed, 21 knots; armed with one 4·7in. and one 3in. gun and eight tubes. These vessels are remarkable for their high speed and the radius of action is also reported to be unusually wide. Other ships launched in 1929 were three anti-submarine net layers, one of 1345 tons and 16 knots, the other two of 450 tons and 19 knots. They are the first specially designed vessels of this type to be built in any country.

France.

Alike in the number and aggregate tonnage of warships launched, France was far ahead of other Powers in 1929. The principal vessels floated were the "Foch," a 10,000-ton cruiser, at Brest on April 24th; "Commandant Teste," a seaplane carrier or tender, of 10,000 tons, at Bordeaux on April 12th; and the "Pluton," a cruiser minelayer of 5300 tons, at Lorient on April 10th. Several destroyers and half-a-dozen submarines also took the water. The "Foch" belongs to the conventional type of 10,000-ton "Treaty" cruiser, but in contrast to the earliest representatives of this class, "Duquesne" and "Tourville," the speed has been reduced and protection improved. A sixth ship of this generic type, "Dupleix," was begun in November, and a seventh has just been authorised. The "Commandant Teste" is in some respects a hybrid, her nearest of kin being the Australian seaplane carrier "Albatross." In spite of her considerable tonnage the French vessel has no landing deck, the machines she carries being projected by means of catapults. Her speed of 20 knots is inadequate, and the armament of twelve 3·9in. guns unimpressive. The minelayer "Pluton," on the other hand, appears to be a very promising design. She is compared below with H.M. cruiser-minelayer "Adventure," and it must be admitted that the French vessel seems to have the best of the comparison.

	"Pluton."	"Adventure."
Length overall, feet	472¼	520
Breadth, feet	51	59
Draught, feet	17	19¼
Displacement, tons	5300	6740
Speed, knots	30	27·75
Armament	Four 5·5in., 250 mines	Four 4·7in., 320 mines

The British ship's advantage lies in her greater mine capacity and the installation of an auxiliary internal combustion propelling plant for cruising, but in speed and gun armament she is outclassed by the "Pluton." The 2780-ton flotilla leaders "Vauban," "Valmy" and "Verdun" were all completed or launched during the year. By reaching 40·18 knots on her steam trials, the "Verdun" established what is claimed to be a world's record, though it was approached to within a fraction, more than ten years ago, by the British destroyers "Teazer" and "Tyrian." The new French leaders are handsome and powerful vessels, heavily armed—five 5·5in. guns, six tubes—with good sea-keeping qualities and ample steaming endurance. They may be regarded as the lineal descendants of the French torpedo-gunboats which caused a flutter on this side of the Channel in the 'nineties of last century.

The submarine cruiser "Surcouf," launched at Cherbourg on November 18th, is the largest submersible craft which has yet been built. She is 393·7ft. in length, 29·5ft. in breadth, and draws 23ft. when in surface trim. Her tonnage is 3250 tons on the surface and 4300 tons submerged. The designed surface speed is 17 knots. According to semi-official details, she is to be armed with four 5·5in. guns in turrets and fourteen torpedo tubes. The deck is armour-plated and the hull so strongly built that the vessel will be able to dive with safety to a depth of 60 fathoms. A hangar is provided for a small seaplane. The "Surcouf" is credited with a radius of 12,000 miles. She is obviously an experimental type, like the British "X 1" and the American "V 4," and as such her career will be watched with interest.

Italy.

No large ship was launched in the past year, but work proceeded on the 10,000-ton cruisers "Zara," "Fiume," "Bolzano" and "Gorizia," which are modified versions of the "Trento" and "Trieste," completed in 1928–29. The four later ships are slower, 32 knots as against 35·5, and have stronger protection—another example of the universal reaction from the original tendency to design these "Treaty" cruisers as mere speed machines—and 8in. gun-platforms, without regard to defensive properties. Official details are now available of the six "Condottieri" cruisers, of 5250 tons, which represent a refreshing departure from the more or less stereotyped 10,000-tonners. Their characteristics are: Length, 597ft.; breadth, 51ft.; draught, 14ft.; geared turbines of 95,000 S.H.P. for 37 knots; protection, a 2in. to 3in. steel deck and splinter-proof turrets. Armament: Eight 6in. guns, paired in turrets; four 4in. A.A. guns, and four torpedo tubes. Once again Italian designers have exhibited their genius for putting extraordinary qualities of fighting power and mobility into vessels of modest displacement. On paper, at all events, these are the most formidable cruisers of their size which have been produced since the war. Among the destroyers launched in 1929 were several of the "Navigatori" class, comprising 12 units. They displace 1908 tons, have a speed of 38 knots, and carry six 4·7in. guns. Eight smaller destroyers of the "Dardo" class, 1350 tons and 38 knots, have been laid down.

Germany.

The only naval unit launched during the year was the "Leipzig," at Wilhelmshaven on October 18th. This vessel is the fifth and last cruiser of the replacement programme, and no further cruising ships are projected for the time being. The "Leipzig" and her predecessors have been dealt with in this journal, and it is only necessary to add that the most has been made of the 6000 tons displacement to which their designers were restricted. Excepting the "Emden," which has eight 5·9in., they all carry nine 5·9in. guns in triple turrets. The speed is 32 knots—"Leipzig" 32·5—and in the "Königsberg," "Karlsruhe," "Köln" and "Leipzig" an auxiliary internal combustion plant is installed to drive the ship at cruising speeds. Electric welding has been extensively employed in the building of the hull, and by this means, together with the use of special alloys, a substantial margin of weight has been saved. They are admirable ships, which would do credit to any fleet. Very little new information has come to hand about the 10,000-ton armoured ship "Ersatz Preussen," which was laid down at the Deutsche Werke, Kiel, in September, 1928, and is to be launched in the coming summer. Her leading particulars and official plans were published in THE ENGINEER of January 11th, 1929. It is known that her displacement of 10,000 tons is a "standard" figure, and that her load displacement will be nearly 14,000 tons. She is to be propelled by internal combustion engines of 50,000 B.H.P., which are being built in the M.A.N. shops at Augsburg. They will operate twin screws through reduction gearing supplied by the Vulkan yard, Hamburg, the revolutions between motor and propeller being reduced in the ratio of 9 to 5. The net weight of the motors is hardly more than 17·64 lb. per brake horse-power. Although the total weight of the complete plant, comprising motors, gearing, shafting, propellers, accessories, &c., will naturally work out at a higher figure per unit of power, it will still be less than that of a modern geared turbine installation of equal capacity. The contract speed is 26 knots, and at a speed of 20 knots she will, it is asserted, have the surprising endurance of 10,000 miles. The armament is to be six 11in. guns in triple turrets, eight 6in. behind shields, four 3·4in. A.A. guns, and six torpedo tubes. For protection she will have an almost complete belt on the water-line, two decks, and extensive subdivision. When, almost exactly twelve months ago, details of the "Ersatz Preussen" were first made known by THE ENGINEER, we ventured to remark that the appearance of such a vessel, with its powerful armament and phenomenal radius of action, introduced a new factor into the naval situation and might eventually necessitate a revision of the Washington Treaty rules governing warship design. These observations were discounted in certain quarters, but they have since found widespread acceptance. There is hardly any doubt that the "Ersatz Preussen's" design will materially influence the decisions reached at the London Naval Conference.

Other Navies.

After lying derelict ever since her launch from the Vulkan yard at Hamburg fifteen years ago, the Greek battleship "Salamis" is at last to be completed and handed over to the Hellenic Navy. Her original design, it is understood, is to be revised, but to what extent is not yet known. She displaces 19,500 tons (normal), and was to have had turbines of 40,000 S.H.P. for a speed of 23 knots. The armament provided for was eight 14in. guns, twelve 6in. and twelve 12-pounders., with three submerged tubes. The decision of Greece to take belated delivery of this ship is traceable to the expansion of the Turkish fleet. The latter has recently been strengthened by the "Yawuz Sultan Selim" (ex-German battle cruiser "Goeben"), which was thoroughly refitted at Constantinople by the French firm, Chantiers de St. Nazaire. Moreover, the Turkish Government has under construction in Italian yards two 1350-ton destroyers of 36 knots, and two submarines, of 950 and 880 tons respectively.

The past year witnessed the completion by British firms of important naval contracts for South America. Of these the largest was that booked by Thornycrofts, late in 1927, for six Chilian destroyers. They were of uniform design, 1090 tons and 35 knots, and all exceeded the contract speed on trial. For the same Government Vickers-Armstrongs have just delivered three submarines of 1540 tons, which closely resemble the British "O" class, and launched in November the submarine depôt ship "Araucano," of 4000 tons gross. Further, Vickers-Armstrongs are building two Chilian naval oil-tankers, each of 3800 tons gross. For the Argentine Government, J. Samuel White and Co., of Cowes, have completed three flotilla leaders of 1520 tons. The designed speed is 36 knots, but the "Mendoza" and "Tucuman," on trials, maintained 38 knots for 6 hours, and "La Rioja" reached a maximum of 39·4 knots. We understand that the South American Governments concerned are more than satisfied with the warships they have recently had built in this country, and there are some grounds for anticipating the receipt of further contracts from the same source. The Argentine cruiser "Veintecinco de Mayo," built by Orlando Bros., of Leghorn, was launched on August 11th. She is a vessel of 6800 tons, a designed speed of 32 knots, and a main armament of six 7·5in. guns. A sister ship is shortly to be launched at the Odero yard, Sestri Ponente.

Electrical Engineering in 1929.

No. I.

As far as the export business was concerned, the condition of the electrical industry during 1929 was satisfactory, but in the home market the state of affairs was decidedly less favourable. While the industrial production as a whole was higher than in 1927 or 1928, owing to a series of crises on the Stock Exchange which affected financial operations, few of the larger industries were able to carry out schemes of renovation or extension of equipment. On account of the severe depression ruling on the Stock Exchange and to the constant loss of gold to France and Germany, financial conditions were unusually difficult, and new capital raised by industry was probably lower than in any other post-war year. On the other hand, electricity supply shares on the Stock Exchange were only slightly affected and the supply companies were

able to raise all the capital they required. The record of the home orders for plant, &c., was, however, somewhat disappointing in view of the circumstances, for in spite of the orders placed by the Central Board, the increase in employment in the industry in 1929 as compared with 1928 did not materially improve the unemployment curve; in other words, the orders placed by the Central Electricity Board have merely served to make good the very real depression that existed in the home business. The new generating stations put into operation during the year include the Hams Hall station of the Birmingham Corporation, the Portishead station of the Bristol Corporation, the Kearsley station of the Lancashire Electric Power Company, the Deptford West station of the London Power Company, the Morden station of the Swindon Corporation, and the Slacks Valley station of the Oldham Corporation. Views of the Hams Hall station (60,000 kW), the Portishead station (41,100 kW), the Kearsley station (64,000 kW), and the Slacks Valley station (37,500 kW) are given in our Supplement. The Commissioners' latest figures show a total capacity of plant installed in generating stations of 5,700,000 kW, whilst the statistical department of the B.E.A.M.A. estimates that the total capacity of all generating plant in this country at the present time, including that used in industry, is 8,900,000 kW.

In the monograph recently published by the B.E.A.M.A. statistics were brought up to the end of 1928 and foreign returns up to the end of September, 1929. The decline in exports during the years 1927 and 1928 came to an end in the summer of 1929, with the result that the total figures for the whole year 1929 will undoubtedly establish a record for the industry. In 1929 the position very greatly improved, especially in the latter half of the year, and British firms were able to take part in the expansion of demand from the Continent and secured important orders from such countries as Holland, Russia, Hungary, Greece, and Spain. They were also able to obtain a considerable number of small orders from markets which had not hitherto been considered open to British firms. The electrical and allied machinery export shipments reached a very high level in 1929, and will probably show a further increase in 1930. The demands from the Australian market were maintained at a high figure, some of the largest developments being in mining, as the result of which a considerable number of contracts were placed. The growth in public electricity supply in Australia has also led to the placing of important orders for generating plant and distributing equipment by municipal undertakings. Railway electrification in Australia also led to the placing of contracts for tractive equipment with British firms. Similarly in India some of the most important contracts recently received have been in connection with railway electrification. Another important development in India was the growth in the industrial demand for electrical machinery, and much work was done in connection with the development of electricity supplies. The national supply system of New Zealand led to the award of important contracts. The work in connection with the Waitaki section of the Lloyd Mandeno hydro-electric scheme was shared mainly by three British firms. The next market in order of importance was Africa, where the principal developments were in connection with the electrification of mines. There was also progress in municipal electric lighting, and a large set is being supplied to the Victoria and Transvaal Power Company. Work is being carried out by several firms for the Town Council of Johannesburg. Among the most important mining contracts were those for an important concern in Rhodesia. Contracts from the South American market were widely distributed. Two orders for turbo-alternator plant were received from a Brazilian supply company. Equipment was also supplied to companies in the Argentine and Montevideo. A considerable amount of alternating-current plant and switchboards were delivered in this region for various gold mining concerns.

Among the most interesting of the recent electrical developments in Asiatic countries have been the rapid extension of the Japanese railways, resulting in many orders being placed with British electrical firms. As regards Southern Asia, an important contract was placed by the Perak River Hydro-electric Company. Much work is also being done in connection with the development of the Anglo-Persian Oil Company, and other important work is being carried out in the East. Egypt was an important customer. Turbo-generators are being supplied to Port Sudan, and for the Belquas power station of the Egyptian Government. In Palestine the Jordan power-house and the Haifa and Jaffa sub-stations are being equipped by a British firm. Contracts were received for industrial equipment for the Federated Malay States and Canada, and contracts for electric power plant from Nova Scotia and Madeira. An interesting development in the Canadian market was the equipment of a large number of hotels with British engines for providing heat and power.

Electricity Schemes.

A scheme for Mid-East England was adopted during the year by the Central Electricity Board, and another was published for North-East England. The Mid-East Electricity Scheme, 1929, published in its adopted form on March 28th, comprises an area of 7545 square miles, with a population of 4,666,500, and broadly it covers the East and West Ridings and a small portion of the North Riding of Yorkshire, the counties of Lincoln and Rutland, and parts of the counties of Nottingham and Derby. It includes densely populated areas where important industries, such as coal mining, iron and steel making, engineering and textile manufactures are carried out, and wide tracts of agricultural territory, which at present are unprovided with any system of electricity supply. The scheme includes the area of supply of seventy-three authorised undertakers, and out of a total of forty public generating stations now in operation or under construction in the area, sixteen have been selected, whilst sixteen more stations may be operated under temporary arrangements during the carrying out of the work specified in the scheme. As in the cases of previous schemes, the main transmission lines are being designed to give alternative routes, so as to provide security against failure of supply. Associated with the principal main transmission lines there will be sixteen main transforming stations and ten secondary transforming stations associated with the secondary transmission lines. Work connected with the standardisation of frequency will be unnecessary in this particular case. In all five schemes already adopted, rapid progress was made with the constructional work, and on the 132-kV routes towers were erected over a distance of nearly 200 miles. In Central Scotland over 47 route miles of 132-kV lines and five transforming stations connecting these lines to the generating stations at Bonnybridge, Dalmarnock, Clydesmill, Yoker, and Greenock are in operation, and at these five stations transformers with a total capacity of 220,000 kVA and varying from 15,000 to 60,000 banks, are in use. The lines between Yoker and Greenock cross the rivers Clyde and Cart with high water clearances of 228ft. and 188ft. respectively. The four towers are 270ft., 283ft., 218ft., and 218ft. high. The remainder of the lines are of normal construction. On the Bonnybridge–Dunfermline route the lines will cross the Forth where towers 338ft. high have been erected to give a high water clearance of 158ft., and a span of 3050ft.

In South-East England a section of the line between Bedford and Little Barford, designed for a pressure of 132 kV, is in temporary operation at 33 kV. Thirty-three thousand-volt cable routes were put into operation between Croydon and Epsom and between the Willesden stations of the London Power Company and the North Metropolitan Company; whilst 66-kV cable routes are in operation between St. Pancras, Islington, and Hornsey. In North-West England, a 33-kV overhead line connecting Stockport, Marple, and Macclesfield is in use for giving a supply to the High Peak and Trent Valley Company at Marple, and a standby supply to Macclesfield. Constructional work is well advanced on other schemes, and during the present year there will be large additions to the principal and secondary lines and transforming stations in operation. Up to the present, the contracts for transmission lines and transforming equipment represent approximately £10,700,000.

Rural Electrification.

The interest that is being taken in rural electrification is indicated by the fact that during the period under review Mr. Borlase Matthews has dealt with a very large amount of correspondence from people anxious to know where they could obtain electrically operated farm machinery, and this experience, we are told, was shared by manufacturers. Recent legislation empowers the granting of loans to electricity supply undertakings, and as these loans are available for rural work they should encourage undertakers to extend their mains into rural areas. While this country has not yet got to the point reached in New Zealand, where certain farmers have been allowed to put up their own lines, there are indications that a further revision of the rules governing overhead lines is probable. Supply undertakings are becoming more up to date in their publicity methods. The South Wales Electrical Distribution Company, for instance, has aroused considerable interest in rural electrification by sending an electrically equipped demonstration van throughout the countryside. At recent agricultural shows there has been an increase in the number of the electricity supply undertakings' stands. At the Royal Show one of the coveted Silver Medals was won by an electrically driven refrigerator. In the North of England, Mr. Matthews tells us, tubular electric heaters are to be found in a well-known orchid house. On American fruit farms apple spraying is done with the aid of a small electric motor, whilst in Japan over 11,000 electric lamps are used in the work of insect and moth destruction, and ultra-violet light is applied to racehorses and live-stock. It is estimated that in Germany, where there are 2¼ million horse-power of electric motors in operation on farms, agriculture has the fourth highest capacity of electrical power-consuming plant in the country, iron and steel and coal mining being the only industries that absorb more power. Over 3000 British farmers are now using electric power, and the past year witnessed the granting of powers to supply a large rural area in Lincolnshire, which in due course will greatly increase this total. Under a motion put by Mr. Daniel Hopkin, rural electrification had a lengthy debate in Parliament, when Sir Douglas Newton expressed the hope that Parliament would allot a day each year to that subject, which, he said, was becoming increasingly popular in all quarters. The Electricity Commissioners also convened another meeting of the Rural Electrification Conference, which is to make a report early this year. During 1929 two Committees became operative—one to look into the question of tariffs and the other to examine hire-purchase facilities with a view to their application in rural electrification schemes.

Generating Plant.

In the field of large power plant the position of British manufacturers was maintained. The 41,000-kilowatt set built by the Metropolitan-Vickers Electrical Company for the Barton station of the Manchester Corporation was put into operation, and on its official test it showed a very good efficiency. Among larger sets now in an advanced stage of construction is a 62,500-kVA set for the Portishead station of the Bristol Corporation and an 80,000-kVA set for the Battersea station of the London Power Company. The Portishead station, of which we give a view in our Supplement, was one of the stations opened during the year, and at present it contains two 20,550-kilowatt Metrovick two-cylinder impulse turbines, designed for a pressure of 300 lb. per square inch and a total temperature of 725 deg. Fah. Power plant contracts placed with the Metropolitan-Vickers Electrical Company during the year showed a substantial advance over those of the previous year, the orders received covering plant with an aggregate capacity of over half a million kilowatts. The progress is rendered the more notable by the fact that the company's business in such plant in the year 1928 showed a very large increase over that of 1927.

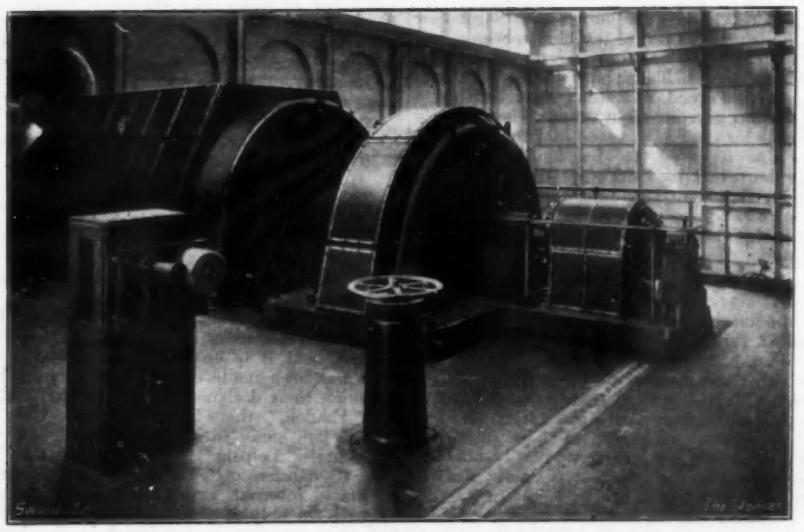


FIG. 1—B.T.H. ALTERNATOR WITH FAN DRIVEN FROM MAIN SHAFT

It is also significant that the work now in hand is well proportioned amongst orders for home installations, for the Colonies, and for countries outside the British Empire. Among the large Metropolitan-Vickers sets under construction for abroad is a 35,000-kilowatt set designed for a pressure of 600 lb. per square inch and 725 deg. Fah., with steam reheating

between high-pressure and low-pressure cylinders. Another notable set is a 40,000-kVA, 3000-revolution machine for the Victoria Falls and Transvaal Power Company.

The Kearsley power station of the Lancashire Electric Power Company, which contains two B.T.H. 32,000-kilowatt sets and which is illustrated in our Supplement, was put into operation, and it is expected that the excellent results obtained at the Padiham station of the Lancashire Electric Power Company will be surpassed at Kearsley, where the steam conditions are 300 lb. gauge, 250 deg. Fah. superheat and 29in. vacuum. An interesting feature of two B.T.H. 25,000, 3000-revolution per minute machines put into operation during the year is the provision of a ventilating fan—see Fig. 1—driven in tandem from the main alternator shaft. Fans of this kind can be more efficiently designed than those mounted on the ends of rotors of high-speed machines. Engineers are also said to prefer this arrangement to that in which the ventilation is effected by separately driven fans mounted in the foundations. The alternator shown is also coupled to a stabilising exciter consisting of a main exciter and service exciter. A 30,000-kilowatt three-cylinder turbo-alternator, of special interest, is under construction at the B.T.H. works. The turbine is designed for a pressure of 1200 lb. per square inch and a total steam temperature of 725 deg. Fah. In the high-pressure cylinder the steam is expanded down to 200 lb. per square inch, and is reheated at this pressure to a total temperature of 550 deg. Fah., a considerable quantity of this steam at 200 lb. per square inch being exhausted for process work. The turbine is of the impulse type, and is designed for a speed of 3000 revolutions per minute. Last year reference was made to a 10,000-kilowatt set designed for a speed of 3600 revolutions per minute, a pressure of 365 lb. per square inch, a total temperature of 1000 deg. Fah., and a vacuum of 29in. This set is now approaching completion, and there is no doubt that its operation in commercial service will be watched with interest. The turbine is of the two-cylinder type, the extra high temperature portion being confined to one cylinder. Three-point extraction is provided for giving a final feed-water temperature for the last heater of 312 deg. at 8000 kilowatts load. The manufacture of the B.T.H. 67,200-kilowatt turbo-alternator set for the Battersea station of the London Power Company is proceeding. The turbine is of the three-cylinder type, and will run at 1500 revolutions per minute, with steam at 570 lb. per square inch, a temperature of 850 deg. Fah., and a vacuum of 29·1in. Another large B.T.H. set in the course of construction is a 50,000-kilowatt maximum rated set for the Ironbridge power station of the West Midland Joint Electricity Board. This machine will operate with steam at 375 lb. per square inch, 750 deg. temperature, and will exhaust into a vacuum of 28·9in. A 20,000-kilowatt, 3000 revolution per minute machine was supplied to Balfour, Beatty and Co., Ltd., for the Derbyshire and Nottinghamshire Power Company at Spondon, and many other interesting sets are at present under construction in the Rugby works.

In the shops of the English Electric Company steam turbines with outputs up to 30,000 kilowatts were under construction, and two sets of this size will shortly be put into service. A number of 25,000-kilowatt sets were also completed. A comprehensive contract for a complete power station in Greece, namely, the St. George's Bay power station, Athens—see Fig. 2—was also completed. The installation includes three 15,000-kilowatt, two-cylinder turbo-alternator sets running at 3000 revolutions per minute, with step-up transformers for transmitting power at 22,000 volts to Athens and its environments. Another important contract upon which the company has been engaged, in association with Ganz, of Budapest, involves the electricity supply for Budapest and the surrounding district and the electrification of the main line railway from Budapest to the Austrian frontier. The English Electric Company is supplying the main turbines, condensing plant and other auxiliaries, the 110-kV power house switchgear and trasnmission lines, and the complete equipment of the sub-stations. The initial equipment of the station will consist of three 23,000-kilowatt, two-cylinder turbo-alternator sets and a 2100-kilowatt house service, and line-charging set.

The orders executed by C. A. Parsons and Co., Ltd., indicate that export trade is increasing. Turbo-alternators were dispatched by this firm to South Africa, India, Canada, and Australasia. Home orders of equal importance were also carried out. The largest single-cylinder turbine in existence running at 3600 revolutions per minute was built and tested, and dispatched to Canada. It is a 15,000-kilowatt, pure reaction machine, with duplex exhaust, and is remarkable on account of its short overall length. A similar Parsons machine has just been put into service at the Derby Corporation works, but in this case the speed is 3000 revolutions per minute. The most economical load is 16,000 kilowatts, and the maximum continuous load 20,000 kilowatts. These two single-cylinder turbines are said to be the largest of their kind. They are essentially high-efficiency machines, and by the use of the duplex exhaust are able to take full advantage of the high vacuum at which they work.

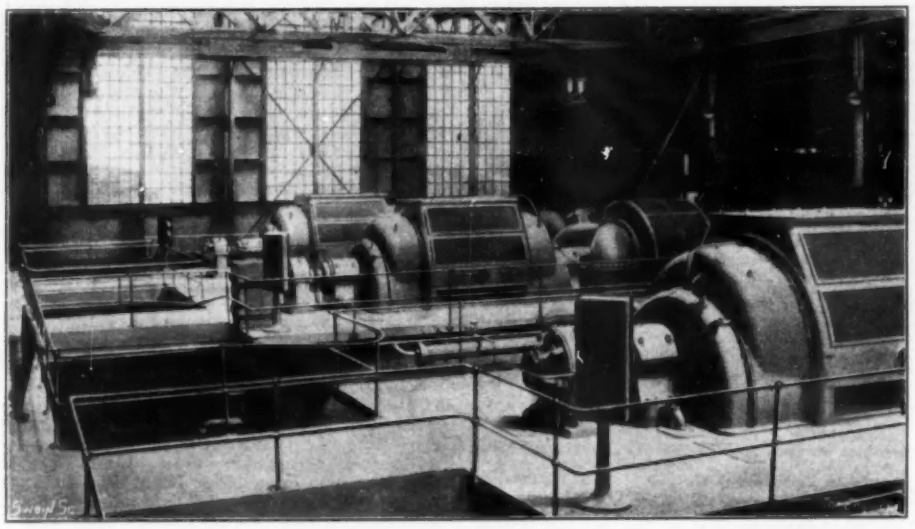


FIG. 2—ST. GEORGE'S BAY POWER STATION, ATHENS—ENGLISH ELECTRIC

A single exhaust, single-cylinder Parsons 20,000-kilowatt, 3000 revolutions per minute turbine is also being built for India. Tandem-cylinder machines have been supplied as in the past, and two 30,000-kilowatt sets are at present under construction for the new power station at Ymuiden, North Holland. A 25,000-kilowatt set was also put into service at Treforest, South Wales. The electrically welded mild steel form of construction is now almost standard at the Parsons works for such parts as alternator stator casings, bed-plates, gear case covers, &c. Welded sheets have also been employed for large condensers. An outstanding development in turbo-alternator construction is the patented method for the production of sound steel ingots which formed the subject of a paper by the Hon. Sir Charles A. Parsons and Mr. H. M. Duncan before the Iron and Steel Institute on May 3rd, 1929.

An outstanding General Electric contract was the order of two 37,500-kVA turbo-alternators and the direct-current house generators to the Hams Hall power station, which is illustrated in our Supplement. In due course, the Hams Hall station will be a 50-cycle station, but at present the alternators generate at 25 cycles per second.

In the turbine department of the Fraser and Chalmers Engineering Works there were interesting developments in steam turbine design. A machine built for a paper mill in Kent is of the two-casing, double-pass-out type, and has a capacity of 10,000 kilowatts. In a paper mill very fine regulation of the process steam at constant pressure is called for, and the pass-out gear developed at Fraser and Chalmers works gives the desired result. The gear is interconnected with the main throttle and the turbine speed is unaffected by fluctuations in the amount of steam extracted. The turbine operates at a pressure of 290 lb. per square inch, and has two pass-out ports, one giving steam at 105 lb. per square inch and the other 18–20 lb. Turbines of 30,000 and 15,000 kilowatts capacity and designed for a speed of 3000 revolutions per minute are under construction.

Transformers.

The British "grid" has given rise to a considerable demand for large transformers, designed for tap changing under load. Deliveries of 33,000-volt, three-phase power transformers have been begun by the B.T.H. Company for the South-Eastern area, and orders are in hand for 132,000-volt transformers for the North-Western England and North Wales area, and the Central England area. These 132,000-volt, three-phase units range in size from 15,000-kVA to 60,000 kVA, and tap changing on load equipments are incorporated in all the units. The same firm has also recently dispatched three 12,000-kVA, three-phase transformers with automatic on-load tap-changing equipments to Dublin, where they will be used in the Fleet-street sub-station and will form the only link in the Irish grid scheme between the distribution system fed from the Shannon hydro-electric station at Ardnacrusha and the existing distribution system of Dublin, fed from the steam generating station at Pigeon House Fort. As these transformers will be required to supply power in either direction, it has been necessary to design them for a large variation in the ratio of transformation, *i.e.*, 25·7 per cent. in terminal pressure on the high-voltage side. Under normal conditions this variation will be controlled automatically and manually under special conditions. The work being carried out in the B.T.H. transformer department has recently been described in our columns;* but mention may be made of a power transformer designed to give 433,000 $\sqrt{3}$ volts continuously with the neutral solidly earthed. Over 250,000 kVA of the transformer orders received and executed by the Metropolitan-Vickers Electrical Company were for pressures of over 100 kV, and over half of the company's total output was for transformers of the single-phase shell type and approximately 50 per cent. of the transformers built were designed for outdoor service. Four single-phase 17,000-kVA, 132-kV, single-phase shell type transformers are being built by this firm for the State Electricity Commission of Victoria, and three of these units will form a 51,000-kVA, three-phase bank, the remaining unit serving as a spare. Another interesting Metro-Vick order is for a 6000-kVA, three-phase bank, consisting of three single-phase, 2000-kVA units in one tank for the operation of an electric furnace at the works of the Rand Carbide Company. The pressure required by the furnace varies from 90 to 130 volts, and the current is 42,000 amperes. Repeat orders for 132,000 volt transformers and similar to those that have been in operation at the Witbank power station for four years, were received from the Victoria Falls Company. Other large Metro-Vick transformers have been made for the London Power Company, the new Clarence Dock power station of the Liverpool Corporation, and for the Barton station of the Manchester Corporation. The size of the firm's naturally-cooled three-phase transformers is continually increasing, and six three-phase transformers of 10,000 kVA and 12,000 kVA have recently been completed for Manchester, Salford, and Stretford. All these transformers have tanks and external cooling tubes, but the Salford transformer also has detachable radiators fitted on the short ends for detachment during transport on to the site on account of certain restrictions of space at the Agecroft power station. The 10,000-kVA Manchester unit also has a fan which is brought into use when the full output is required. Like other transformer builders, the Metropolitan-Vickers Electrical Company experienced a great increase in the demand for on-load voltage regulating gear. The 1,000,000 testing transformer in the company's research department was operating during the year at about half its full pressure. The equipment consists of two half-million-volt transformers connected in series.

The nature of the transformer work that was undertaken in the English Electric Company's factory was described pretty fully in our issue of August 30th, 1929. Besides the 132 kV transformers which were ordered by the Central Electricity Board in 1928 for Central Scotland and which have now been constructed, the company received orders for about 140,000 kVA of 33 kV transformers for the North-west England, South-East England and Central England schemes. All these 33 kV and 132 kV transformers are fitted with on-load tap-changing gear, which has proved highly satisfactory in Scotland Many other transformers for pressures ranging from 11 kV to 110 kV are in hand. The 132 kV "grid" units, it will be remembered, give more than 50 per cent. of their rated output as naturally cooled units, whilst for higher outputs air blast cooling is automatically brought into action. For use in connection with rural electrification schemes very small transformers have been supplied for connection to 33 kV lines on the primary side. One of the most interesting developments of the year was the putting into operation of the high-voltage laboratory of Siemens Brothers, of Woolwich. This laboratory was entirely equipped by the English Electric Company, and is designed to enable tests on three-phase or single-phase cables at pressures up to 450 kV, and transformers are installed so that the cables can be supplied with load current while they are under voltage tests up to 100 kV. There is an oscillograph for recording the wave form up to 100 kV, whilst for loss measurements there is a Duddell-Mather wattmeter and high-pressure Schering Bridge for measurements up to 100 kV. An equipment has also been installed for supplying 200,000-volt direct-current. As is well known, the English Electric Company specialises

* See THE ENGINEER, November 29th, 1929.

in the manufacture of induction regulators, and during the year many of these regulators were constructed. Four of these regulators were designed to give plus and minus 10 per cent. regulation on 10,000 kVA, three-phase 6·6 kV feeders.

(To be continued.)

Steamships and Steam Marine Engineering in 1929.

No. I.

THE returns from shipbuilding yards and marine engineering shops show that in 1929 the industry enjoyed a fair measure of prosperity, and that a comparatively high level of production, if not quite as high as last year, was maintained.

The fact that a high output was achieved with a smaller number of men employed is to be explained by the absence of disputes—excepting the long-drawn-out strike of shipyard joiners at Belfast, happily settled before the end of the year—and the general good relations which continued to exist between the Shipbuilding Employers' Federation and the various trade unions whose members are engaged in shipyard activities. There is no doubt also that account must be taken of the very efficient state of our shipyards which enabled very good deliveries to be given.

Before discussing the advances made and mentioning some ships of outstanding interest, we may refer to the tonnage outputs in some of the principal districts, which figures include, of course, both steamships and motor ships.

On the Clyde, 234 vessels, representing 565,798 gross tons, were launched. These figures are lower than those for 1928 by seven ships and some 38,000 tons. It is interesting, however, to note that the total I.H.P. of engines rose from 673,907 to 750,237, an advance over 1928 of 76,330. This increase is partly to be accounted for by the machinery of destroyers built at Clydebank and Greenock, and low-pressure turbines installed in existing ships in connection with the Bauer-Wach drive.

Of the above-named totals, Harland and Wolff, Ltd., launched at its Clyde shipyards 49,274 gross tons and completed 67,930 I.H.P. at its Glasgow establishments. These returns, added to the 91,077 gross tons launched at Belfast and 103,800 I.H.P. of machinery completed at Belfast, mark a large increase over last year's figures. At Belfast, Workman, Clark (1928), Ltd., launched and completed seven ships representing 53,900 gross tons and 32,300 I.H.P. of machinery.

Other figures of interest on the Clyde were those for Lithgows, Ltd., of Port-Glasgow, which firm launched eighteen ships aggregating 91,327 gross tons, also an increase on last year's output. At the Clydebank yards of John Brown and Co., Ltd., there were launched 45,007 gross tons and 113,600 I.H.P. of machinery was completed.

Tonnage outputs on the Tyne, Wear, and Tees were well maintained, and the combined output of Swan, Hunter and Wigham Richardsons, Ltd., on the Tyne and Wear, including those of the allied company of Barclay, Curle, Ltd., of Glasgow, amounted to 161,457 gross tons, an increase of 2562 tons on the preceding year's output. At Birkenhead, Cammell Laird and Co., Ltd., launched a total of 57,929 gross tons, which was somewhat lower than that for the previous year; 41,170 I.H.P. of machinery was also completed, some of this, in the case of motor vessels, being supplied by other firms of engine builders.

Although most of the shipyards were fairly well employed throughout 1929, and nearly all begin the New Year with a certain amount of work already in hand, it is generally understood that competition is as vigorous as ever. Whilst prices obtained are still unremunerative, and show no upward tendency, the new scheme for national wage arrangements for shipyard workers may result in some increase in wages cost and the price of materials is inclined to rise.

Some Large Liners of 1929.

The commissioning of the new North German Lloyd liner "Bremen"—see to-day's Supplement—and her exceptionally good performance, which gained for her the Blue Ribbon of the Atlantic, focussed renewed attention on the Tyne-built champion, the Cunarder "Mauretania," the holder of the Atlantic speed record for so many years. In making any comparison between the two liners, it is well to bear in mind the great difference in propelling power. The "Bremen," which was built and engined at the Weser Shipyard at Bremen, has a length of 933ft., with a beam of 100ft. and a depth of 53ft., her measurement being 46,000 gross tons. She is propelled by quadruple-screw, high-pressure turbine machinery, with a service output of 100,000 to 105,000 S.H.P. and a designed maximum continuous output of 130,000 S.H.P. The smaller powers correspond, according to Prof. Dr. Bauer, to an average speed of 27·24 knots and the highest power to a probable speed of 28¼ to 28½ knots. On her record voyage last July the "Bremen" made an average speed of 27·83 knots.

It is of interest to compare this speed with the two recent passage performances of the "Mauretania" of August, 1924, and August, 1929—see the table below—when with powers of only 68,000 and 80,000 average S.H.P. she made average speeds of 26·25 and 27·32 knots. Although some new auxiliary machinery was recently fitted, it could not have had a very great effect on the power developed since the machinery developed a total output of over 80,000 S.H.P. on the occasion of her trials in 1907. The magnificent performance of the "Mauretania" reflects the highest credit on her designers and builders and the manner in which she has been operated over a period covering more than twenty years of regular service.

S.S. "Mauretania," Record Passage Data.

Ambrose Channel Light Vessel to Cherbourg.

1924.	Day's run, knots.	Average speed, knots.
Wednesday, August 20th	3	24·98
Thursday, August 21st	622	25·91
Friday, August 22nd	626	27·05
Saturday, August 23rd	607	26·24
Sunday, August 24th	598	25·93
Monday, August 25th	581	25·64
Tuesday, August 26th	161	28·00
Total distance	3198	
Time		121 h. 49 min.
Average speed		26·25
Mean slip, per cent.		9·7
Average S.H.P.		68,000
Mean ocean displacement		37,200 tons
Admty. constant		267

Ambrose Channel Light Vessel to Plymouth.

1929.	Day's run, knots.	Average speed, knots.
Friday, August 16th	243	27·10
Saturday, August 17th	611	26·55
Sunday, August 18th	630	27·55
Monday, August 19th	634	27·56
Tuesday, August 20th	636	27·65
Wednesday, August 21st	344	26·91
Total distance	3098	
Time		113 h. 50 min.
Average speed		27·22
Mean slip, per cent.		15·2
Average S.H.P.		80,000
Mean ocean displacement		37,160 tons
Admty. constant		253

With the commissioning of the two 20,000-ton twin-screw liners the "Duchess of Richmond" and "Duchess of York," which entered the Canadian Pacific Railway Company's Liverpool–Montreal and cruising services on January and March of last year, the programme for the construction of four "Duchess" class liners was completed. We illustrate the "Duchess of York" in the Supplement, and she and her sister liner were both built and engined by John Brown and Co., Ltd., at Clydebank, the design of the combined installation of Yarrow water-tube boilers and Scotch auxiliary boilers and high-pressure Parsons single-reduction geared turbines being carried out to the specification of Mr. J. Johnson, the Superintendent Engineer of Canadian Pacific Steamships, Ltd.

A full account of the performance of the sister liners the "Duchess of Bedford" and the "Duchess of Atholl" was given by Mr. Johnson in his paper on "The Propulsion of Ships by Modern Steam Machinery," read at the 1929 Spring Meetings of the Institute of Naval Architects. This paper was reprinted in our issue of March 29th, 1929. It will be recalled that in the "Duchess" class liners a steam pressure of 340 lb. per square inch, with a total superheated steam temperature of 680 deg. Fah. at the turbine stop valve, is employed, along with a vacuum of 29in. of mercury. Under these thermal conditions fuel consumption of the order of 0·57 lb. of oil per S.H.P. hour for propulsion alone and 0·625 lb. for all purposes was obtained in regular service.

The combination of Yarrow high-pressure water-tube boilers with cylindrical boilers for supplying steam for auxiliaries and make-up water has proved reliable and simple in practice, and this essential part of Mr. Johnson's scheme will be embodied in the machinery for the two large trans-Pacific liners the "Empress of Japan," recently launched at the Fairfield yard, and the "Empress of Britain," now under construction at John Brown's Clydebank yard. In these two larger liners steam pressures of 375 lb. per square inch, with a total superheated steam temperature of 700 deg. Fah., are to be used, and it is expected that the machinery will enable a consumption of 0·60 lb. of oil fuel for all purposes to be comfortably realised.

Towards the end of the year the Fairfield-built C.P.R. liner "Empress of Canada" was re-engined and fitted with a more economical type of turbine. The boilers were also equipped with a new type of smoke tube superheater, designed by Mr. J. Johnson, in conjunction with the North-Eastern Marine Engineering Company, Ltd., in which the top row of the smoke-tube superheater projects into the combustion chamber 9in., the projection gradually decreasing to 4in. at the bottom. The arrangement is designed to give a steam temperature of 650 deg. Fah. at the superheater outlet. The turbines have a designed service output of 26,000 S.H.P., and a maximum output of 29,000 S.H.P. An average speed of 22·4 knots was obtained on trial, as against a speed of 19 knots with the original machinery. A description of the machinery of the "Empress of Canada" was given in THE ENGINEER of October 11th. On her voyage out the liner ran aground near Vancouver Harbour, but happily the damage was slight and was repaired by drydocking. In our issue of December 20th we recorded the launching of the "Empress of Japan" at the Fairfield yard, and Captain James Gillies's review of past and future Canadian Pacific marine engineering progress.

In the autumn of last year the Orient Line to Australia took delivery of the fifth liner of the "Orama" class, the "Orontes," a view of which is given in Fig. 1. She is designed for cruising and for the Australian run, and has a length of 630ft. between perpendiculars, with a breadth of 75ft. and a measurement of about 20,000 gross tons. She is propelled by 20,000 S.H.P. Parsons twin-screw single-reduction geared turbine machinery, and with her modern electrically operated auxiliary machinery showed very economical results in service. It will be remembered that four other sister liners referred to, the "Orama," "Otranto," and "Orford" were built at Vickers-Armstrongs Naval Construction Yard at Barrow-in-Furness, and the "Oronsay" by John Brown and Co., Ltd., on the Clyde.

A liner of more than usual interest from the marine engineering point of view, which is illustrated in Fig. 2, is the 377ft., 5000-ton liner "Président Dal Piaz," which was built and engined for the Compagnie Général Transatlantique by Swan, Hunter and Wigham Richardson, Ltd. She will be employed in Mediterranean service, and is equipped with accommodation for 132 first-class, 168 second-class and 92 third-class passengers, and modern cargo-carrying holds and equipment. The propelling machinery comprises a twin-screw arrangement of Parsons turbines of 5000 S.H.P. output, with a propeller speed of 155 r.p.m. The boilers, four in number, are of the Prudhon-Capus combined fire-tube and water-tube type, designed for a working pressure of 255 lb. per square inch, and oil fired on the Wallsend-Howden forced draught system. They were supplied by the Chantiers Navals et Chaudronneries du Midi. An independent separately oil-fired superheater unit, designed by the Superheater Company, Ltd., of London, is fitted, and is one of the first of its type to be utilised for marine purposes. It is furnished with thermostatic controls so that the temperature of the furnace gases and that of the superheated steam can be maintained within well-defined limits. The condensers are of the Delas-Ginabat regenerative type, and a modern two-stage system of feed heating is also provided.

A noteworthy liner of the year, which was fully described in our issues of May 31st and June 7th, was the Holland-America liner "Statendam," which is illustrated in to-day's Supplement. She was built by Harland and Wolff, Ltd., at Belfast, and after completion the hull was towed to Holland and finished by Wilton's Slipway and Engineering Com-

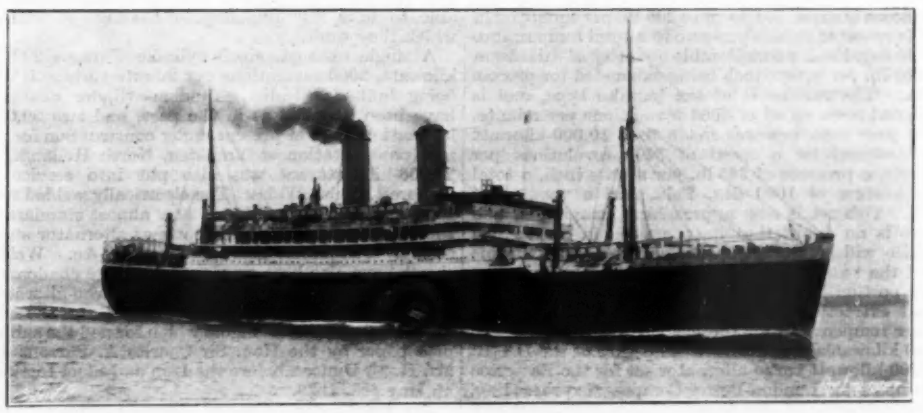


FIG. 1—THE ORIENT LINER "ORONTES"

pany, Ltd., of Rotterdam, which fitted the Harland and Wolff high-pressure turbine machinery. The boilers, six in number, Babcock and Wilcox, for 400 lb. pressure, designed for a total superheated steam temperature of 650 deg. Fah. Special de-superheaters of Babcock design were also added, in order to provide low-pressure steam for auxiliary services. The fuel consumption from New York to Plymouth on the maiden voyage of the "Statendam" worked out at 0·61 lb. of oil per S.H.P. hour for all purposes, which is a noteworthy figure. A detailed account of the machinery and its thermodynamic performance is given in Dr. W. M. Meijers' paper read before the Royal Institution of Engineers in Holland, which was reprinted in our issue of June 7th.

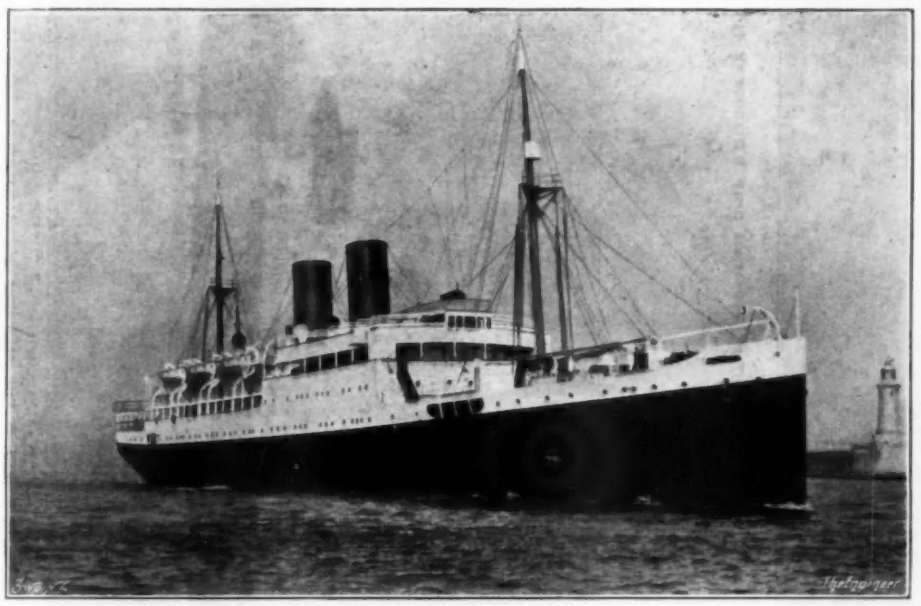


FIG. 2—THE C.G.T. LINER "PRESIDENT DAL PIAZ"

Whaling Factory Ships and Whaling Research.

Among the more specialised ships built last year the two whaling factories "Kosmos" and "Vikingen" may be singled out for mention, along with the Royal Research Ship "Discovery II.," which is to be employed in whaling research in the Southern and Atlantic oceans. The "Kosmos"—a view of which is reproduced in Fig. 4 on page 12—was built and engined by Workman, Clark (1928), Ltd., at Belfast, and she bears the distinction, we believe, of being the first ship to be specially designed as a floating whale oil factory. Up to the time of her laying down practically all the existing whaling steamers had been converted from ordinary ships for their special duties. The "Kosmos" belongs to the Kosmos Whaling Company, of Sandefjord, Norway, and has a length of 550ft. with a beam of 77ft. and a measurement of 17,800 gross tons. The depth to the upper deck is 35ft. 6in., while that to the shelter deck is 50ft. 6in., giving a 'tween deck space of about 15ft. in height, in which all the oil extracting and refining machinery is placed. The weather deck above is arranged to be clear from obstructions in order to facilitate the handling and cutting up of whales, and aft there is a large slipway along which, by means of special winches and derricks, the carcases are drawn. Accommodation is provided for over 300 persons, and provision is made for very long voyages and a continuous supply of fresh water. The propelling machinery consists of a single set of 5200 I.H.P. quadruple-expansion engines taking superheated steam from five oil-fired cylindrical boilers fitted with forced draught and designed for a working pressure of 250 lb. per square inch.

Later in the year Swan, Hunter and Wigham Richardson, Ltd., completed at Wallsend the whale oil factory and mother ship "Vikingen" for the Viking Whaling Company, Ltd., of London. A view of the ship is reproduced in Fig. 3. She has a length of 490ft. between perpendiculars and an extreme breadth of 71ft. and is built on the longitudinal system of framing. The gross tonnage of the "Vikingen" is 14,600 and she is propelled by twin-screw triple-expansion engines having a total designed output of 4850 I.H.P., which gives her a good service speed. The ship is designed to serve either as a floating whale oil factory or as a bulk oil carrier, there being fitted no less than twenty-seven main oil tanks and ten auxiliary oil tanks, besides oil fuel and fresh water tanks at the ends of the ship. The same arrangement of 'tween deck space for refining machinery and a working deck for cutting up the whale carcases is employed, as in the "Kosmos," and in Fig. 3 the end opening leading to the special slipway can clearly be seen. The ship is designed to act as a mother ship to a fleet of five fast whale catchers, and she carries supplies of fuel for these ships. The design and construction of the two whale steamers above referred to was supervised by Messrs. Arnesen Christensen and Smith, Ltd., consulting engineers and naval architects, of Newcastle-upon-Tyne and Oslo.

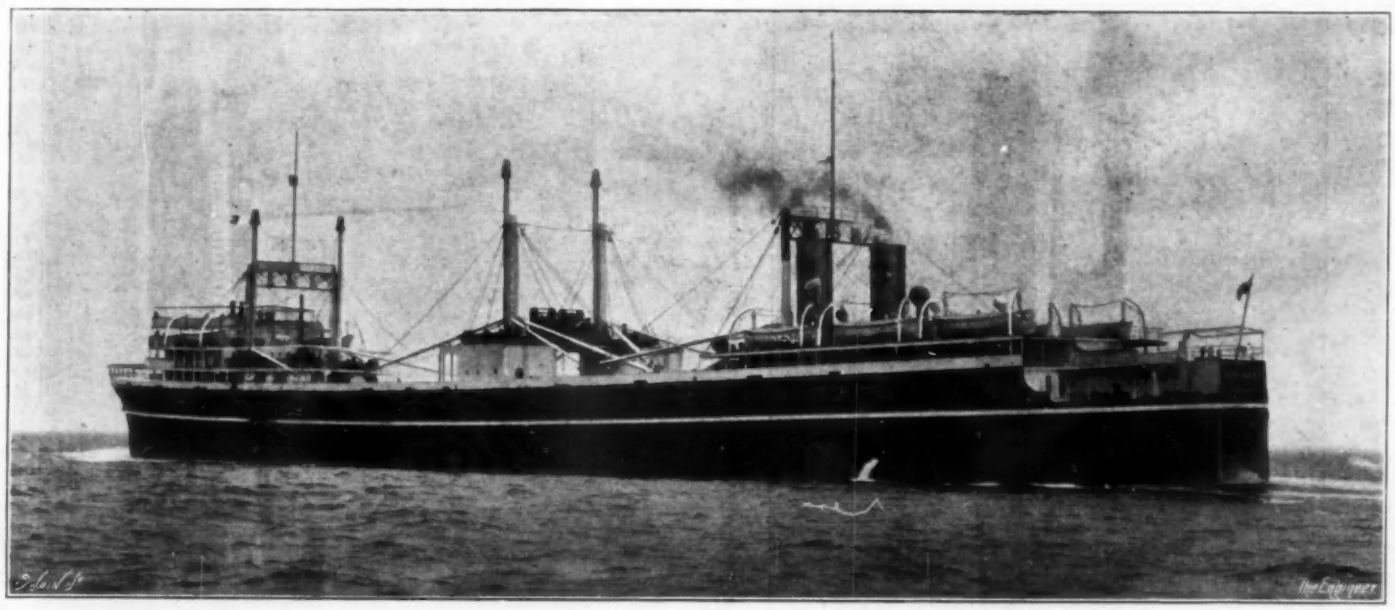


FIG. 3—THE FLOATING WHALE OIL FACTORY AND MOTHER SHIP "VIKINGEN"

The Royal Research Ship "Discovery II."—see Fig. 5 on page 12—which was built and engined by Ferguson Brothers (Port-Glasgow), Ltd., to the designs of Messrs. Flannery, Baggallay and Johnson, consulting engineers to the Crown Agents for the Colonies, was completed in November, and after successful trials left London for service in Southern waters. The duties of this new ship will include the examination of the habits, breeding, food, migration, and the numbers of whales in the Southern and Atlantic seas, for which work she carries a special scientific and navigating staff. She has an overall length of 232ft., with a breadth moulded of 36ft. and a depth of 20ft., and her hull is specially stiffened for service in Arctic waters. Her propelling machinery comprises a set of triple-expansion, three-crank balanced engines designed to work at 200 lb. steam pressure, the steam being supplied from two oil-fired boilers. There is a very complete equipment of auxiliary machinery.

Other contracts connected with the whaling industry included the conversion of the oil tanker "San Patricio" into a whaling factory ship under the name of the "Southern Princess," which work was carried out in record time by Cammell Laird and Co., Ltd., at Birkenhead.

Cross-Channel and North Sea Steamers.

Among the cross-Channel steamers completed in 1929 mention should be made of the Southern Railway Company's express steamer "Canterbury," which was designed and built by Wm. Denny and Brothers, Ltd., of Dumbarton, for the Dover-Calais *de luxe* Pullman and Golden Arrow service between London and Paris. She is a 335ft. ship with an extreme breadth of 48ft. and a depth of 17ft., her gross tonnage being about 2912 tons. Excellent accommodation is provided for the daily complement of about 250 to 300 passengers, and provision is made for many more passengers should accommodation be required. Twin-screw propelling machinery of Parsons latest type is installed and the boiler equipment comprises four Babcock and Wilcox oil-fired boilers with a total heating surface of 17,072 square feet, which are designed for a working pressure of 255 lb. per square inch. The condensing equipment is of the Weir regenerator type, and there are both oil engine-driven and steam-driven electric generating sets, which supply current and lighting for both auxiliary and ship's services. A view of the "Canterbury" is reproduced in Fig. 6 on page 12. Messrs. Dennys also completed two 306ft., 2150 gross tons turbine-driven ships for the Channel Islands service of the Southern Railway Company, named the "Isle of Jersey" and "Isle of Guernsey" respectively.

At Clydebank, Glasgow, John Brown and Co., Ltd., completed the Harwich-Hook of Holland cross-Channel steamer "Vienna"—see Fig. 7 on page 12—and launched the sister ship, the "Prague." A third steamer of the same class, the "Amsterdam," will shortly be launched, and during the present year all three vessels will be placed on the London and North-Eastern Railway Company's service. These ships bear the distinction of being the largest and most luxurious steamers in any cross-Channel service from British ports, and they are designed to carry 450 first-class and 104 second-class passengers. The length between perpendiculars is 350ft., with a breadth moulded of 50ft. and a depth to the shelter deck of 27ft. The gross tonnage is 4218, with a speed on trial of 21½ knots. As will be seen from our illustration, the "Vienna" has a straight stem and a cruiser stern and she is rigged as a two-masted fore-and-aft schooner. The latest safety and navigating

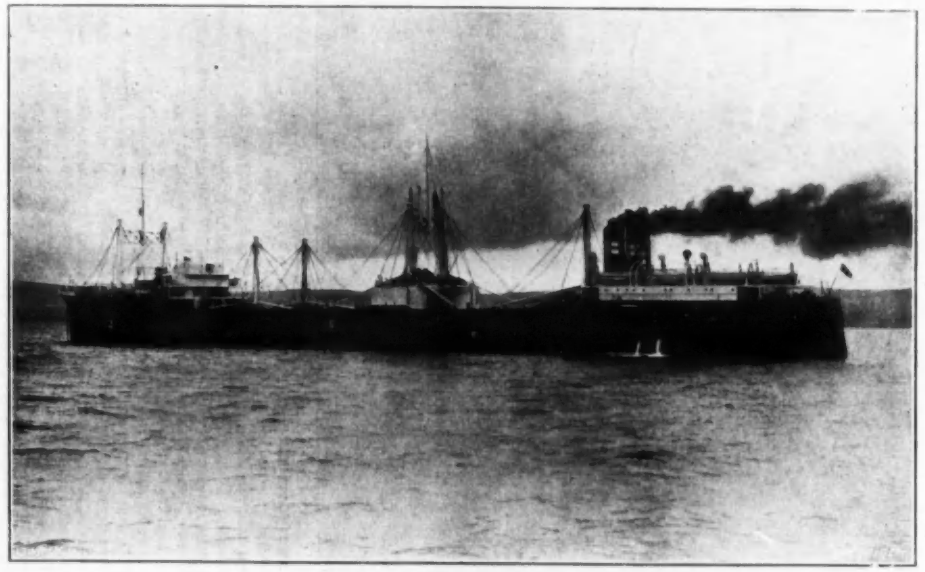


FIG. 4—THE FLOATING WHALE OIL FACTORY S.S. "KOSMOS"

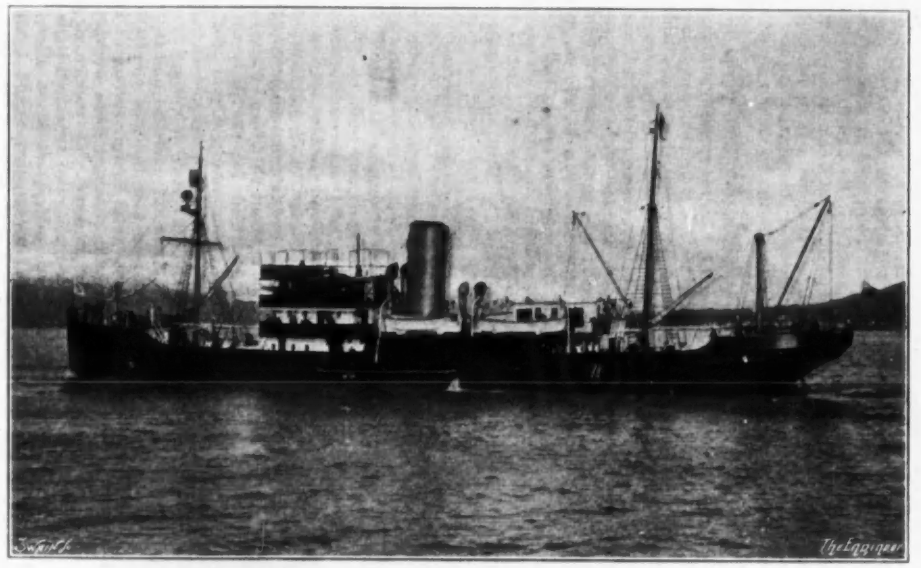


FIG. 5—THE RESEARCH SHIP "DISCOVERY II"

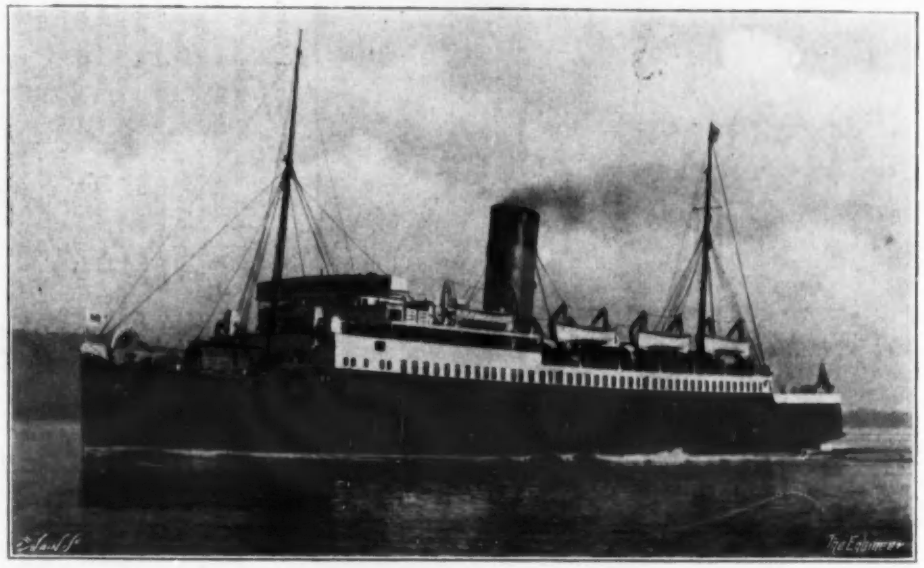


FIG. 6—THE DOVER-CALAIS STEAMER "CANTERBURY."

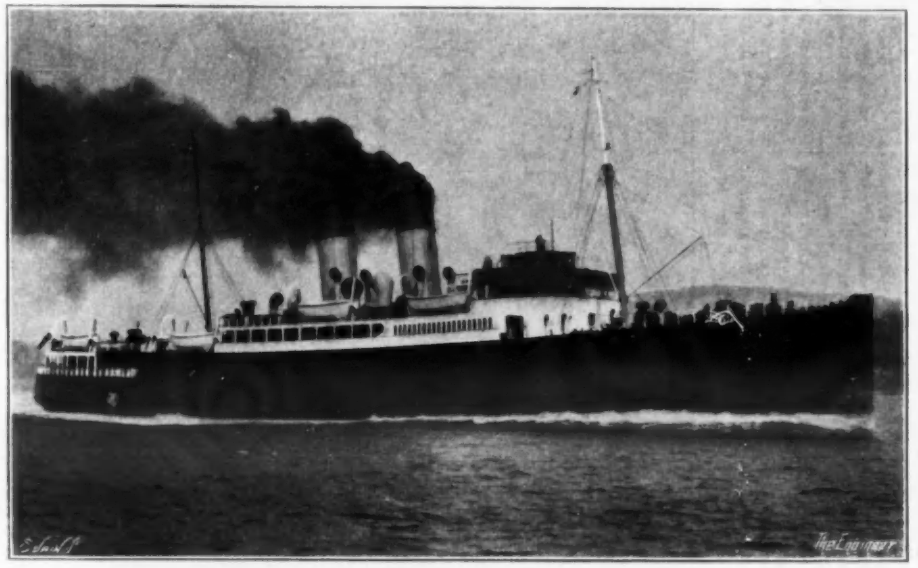


FIG. 7—THE HARWICH-HOOK STEAMER "VIENNA"

equipment is embodied in the design and the public rooms and sleeping accommodation mark an advance in night steamer practice. There are two sets of Brown-Curtis main propelling turbines, driving the twin screws through single-reduction gearing, and the auxiliary machinery includes both electrically driven and steam-driven units, current being supplied from three 125-kW turbo-generator sets. The "Vienna" underwent successful trials on June 28th and a speed of 21¼ knots was obtained, which is about half a knot in excess of the schedule service speed.

Although they are not strictly cross-Channel steamers, we may refer under this heading to the two steamers built by Swan, Hunter and Wigham Richardson, Ltd., of Wallsend, for the Swedish-Lloyd service between Stockholm and London. These ships are the "Suecia" and the "Britannia," the former being decorated in Swedish and the latter in British style. Each ship has a length of 376ft. with a beam of 50ft. and gross tonnage of over 4250 tons, and there is accommodation for 200 first-class and 40 third-class passengers. The propelling machinery comprises a single-screw arrangement of Parsons single-reduction geared turbines, steam being supplied by four single-ended coal-fired boilers with superheaters working under forced draught on the Howden system. The ships have a designed speed of 17 knots, which enables the voyage from London to Stockholm to be accomplished between Saturday evening and the following Monday. During the year some special steamers and motor vessels for the Highlands and the West of Scotland services of David MacBrayne, Ltd., were completed by Harland and Wolff, Ltd., and other Scottish shipbuilders.

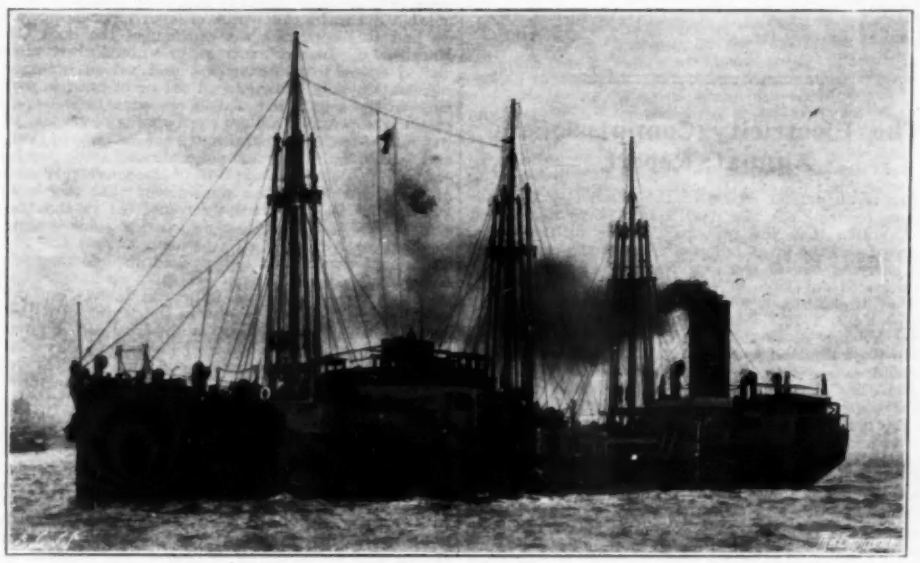


FIG. 8—THE SELF-TRIMMING COLLIER "KAIMIRO"

Cargo Steamers of 1929.

The competition of the fast motor cargo ship caused renewed attention to be paid to the construction of fast cargo steamers with more efficient propelling machinery. On the Tyne, Swan, Hunter and Wigham Richardson, Ltd., completed several cargo vessels for service on the Great Lakes of Canada. Two interesting examples of modern collier practice are the 284ft. ships "Kaimiro" and "Karepo," built by Cammell, Laird and Co. at Birkenhead, for the Union Steamship Company of New Zealand. They are of the self-trimming cantilever type with topside water ballast tanks running the full length of the cargo holds. The holds are three in number, and, as our illustration—Fig. 4—shows, special steel derricks are arranged for discharging the cargo. At each mast there are four steel derricks of 5 tons lifting capacity, and two steel gaffs arranged for 1 ton lifts. The propelling machinery is placed aft, and consists of a single set of triple-expansion steam engines, taking steam from two large single-ended, three-furnace cylindrical boilers, working under Howdens system of forced draught.

Another coal-carrying ship of special interest was the "Berwindlea," built by the Blythswood Shipbuilding Company, Ltd., of Scotstoun, and engined by David Rowan and Co., Ltd., of Glasgow. She is noteworthy on account of her pulverised fuel installation, to which we shall refer in our second article. At Belfast, Workman, Clark (1928), Ltd., launched four 5000-ton cargo liners for the Bank Line, Ltd., and four other vessels are under construction for the same owners at Workman, Clark's yard.

Main and Auxiliary Electric Propulsion.

One of the notable ships of the year was undoubtedly the new P. & O. liner "Viceroy of India," which was fully described in our issues of March 1st, 8th and 15th of 1929. A view of the liner is reproduced in to-day's Supplement. She has a gross tonnage of 19,700 and her length overall is 612ft., with a beam of 78ft. Her propelling machinery consists of two 9000 kW B.T.H. alternators supplying current to two 8500 S.H.P. motors driving the propeller shafts. Steam is raised in six Yarrow water-tube boilers, designed for a working pressure of 350 lb. per square inch with a total superheated steam temperature of 700 deg. Fah. The boilers are fired on the "Clyde" oil-fuel burning system. The "Viceroy of India" was built by Alexander Stephen and Sons, Ltd., of Linthouse, Glasgow, where her machinery was also fitted. On trial and in the course of five cruises and two round trips to Bombay, she met the fullest expectations of her designers and builders, and gave complete satisfaction to her owners, besides gaining high praise from all who travelled on her. The performance of the ship was so satisfactory that it has been decided that the two new Australian P. & O. liners shortly to be ordered shall also be propelled by turbo-electric machinery.

Another interesting auxiliary turbo-electric propulsion installation fitted into a P. & O. liner was that supplied by the British Thomson-Houston Company, Ltd., of Rugby, and fitted by R. and H. Green and Silley Weir, Ltd., of London and Falmouth, under the supervision of Mr. R. T. Clarke, the superintendent engineer of the P. & O. Line in the liner "Mooltan," which left London early in November for Australia and India. We were able to inspect the new equipment shortly before the ship left Tilbury. It consists of two 1900 S.H.P. mixed pressure turbo-alternator sets which take the exhaust steam from the twin-screw reciprocating engines and are also fed with live steam. The two turbine sets are neatly housed in the engine-room wings, and in addition to the alternator there is a direct-current generator on each turbine, which supplies current for lighting and ship's general uses. When running on live steam the sets operate at 2200 r.p.m. under governor control, and when exhaust steam is admitted to the low-pressure end of the turbines, the speed rises to 2780 r.p.m. and the live steam is cut off. The voltage on the direct-current mains is maintained constant by a Tirrill regulator of new design. The alternating current is supplied to two fabricated motors, each of 1320 S.H.P. output, which are of the squirrel-cage induction type and are coupled direct to propeller shafts alongside small fly-wheels. The switchboard is conveniently arranged in a gallery over the motors.

The machinery was tested during a week's run from London to Marseilles early in November, and the following particulars have been supplied to us by the owners:—Between Cap Finestêrre and Tarifa Point a trial was run with the ship loaded at a mean displacement of 25,700 tons. At an average speed of 17·14 knots a total of 14,052 I.H.P.—consisting of 11,372 I.H.P. for the main engines and 2680 I.H.P. for the exhaust steam turbines and motors—was recorded with a propeller speed of 84·25 r.p.m. This output corresponded to about 126 tons of fuel per day for all purposes, representing a 22 per cent. saving in fuel at the full calculated increase of speed allowed for. Between Cape Palos and San Antonio it was possible to run a full power trial with a loaded displacement of 25,500 tons. A mean speed of 17·47 knots at 16,815 I.H.P. was obtained at 89·5 propeller revolutions. The total power was made up of 13,731 I.H.P. for the main engines and 3084 I.H.P. for the exhaust steam turbines and motors.

During the year the British Thomson-Houston Company received orders for main turbo-electric propelling machinery for the reconditioned fruit-carrying ship "La Marea," and for two single-screw fruit cargo ships for Elders, Fyffes, each of 7000 S.H.P., which will be built at Birkenhead and Belfast.

In our issue of November 15th we gave a short account of the auxiliary turbo-electric propulsion equipment installed on the Ellerman liner, the "City of Hong Kong," by the Metropolitan-Vickers Electrical Company, Ltd., in collaboration with Mr. W. Hinchcliffe, the superintendent engineer of the Ellerman Line. The "City of Hong Kong" is a ship of 9678 gross tons built by Earle's Shipbuilding and Engineering Company, Ltd., of Hull, in 1924, and originally propelled by a 4400 I.H.P. quadruple-expansion engine. The work of converting the ship was carried out by Workman, Clark (1928), Ltd., at Belfast. An exhaust turbine has been fitted, supplying direct current to a 1320 S.H.P. auxiliary propelling motor which is mounted on an after-section of the propeller shaft. Electrical and oil-operated controls are fitted, for throwing the exhaust turbine set in and out of circuit. On trials carried out in the Irish Sea, powers of 4900 total I.H.P. for main engine and motor were recorded, with a 23 per cent. saving of steam when the turbo-electric equipment was in operation. The equipment is employed in regular service to give increased speed with reduced fuel consumption, and the excellent promise of the trial results has been fully maintained at sea. Several other equipments of the same type are to be built by the Metropolitan-Vickers Electrical Company, Ltd., for other ships of the Ellerman Lines, and many inquiries for similar equipment were received from British and foreign shipowners.

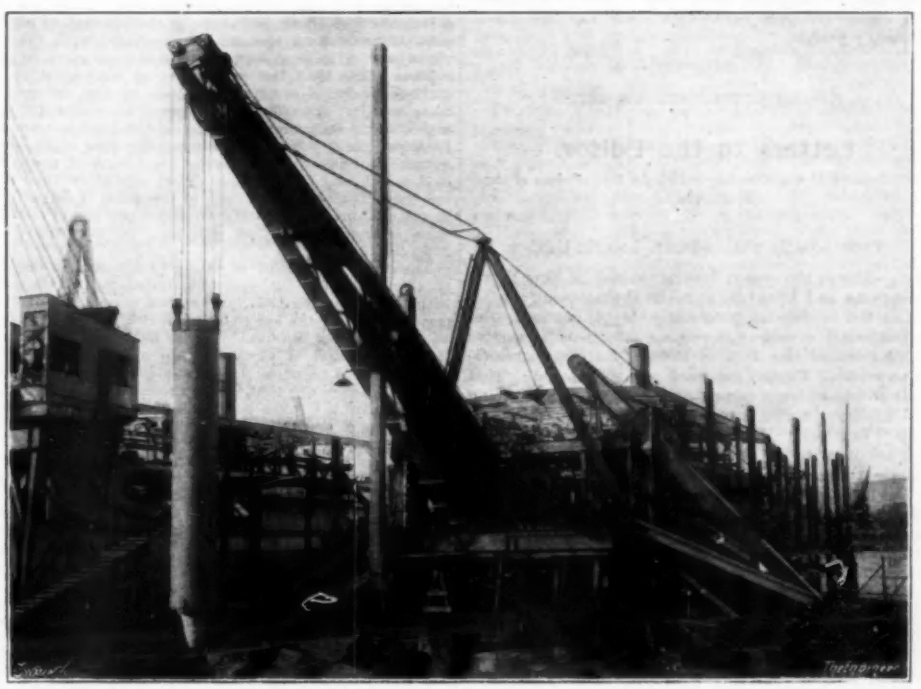


FIG. 9—THE DIPPER DREDGERS, "GAMUSA" AND "KHARTITA"

Some Dredgers of 1929.

Several dredging and rock-breaking plants for home and foreign harbour use were completed in 1929. At Renfrew, Lobnitz and Co., Ltd., built for

the Egyptian Government two dipper dredgers of special interest, for work on the Gebel Aulia Dam, 12 miles south of Khartoum. In Fig. 9 we show these dipper dredgers under construction at the makers' works. After testing under steam they were dismantled and shipped in pieces for re-erection in Egypt. The two dredgers are named the "Gamusa" and the "Khartita" respectively, and their dimensions are 110ft. in length with a beam of 38ft. and a depth of 7ft. The dipper bucket capacity is 2 cubic metres, and the designed dredging depth 6 m. When dumping the total outreach is 25 m. Our illustration shows the patented rock-cutter guide and rock-cutter suspended ready for work.

Another dredger completed by Lobnitz and Co., Ltd., was the "Oliver Bury" for the Hull harbour works of the London and North-Eastern Railway Company. The dredger is of the non-propelling type, designed to cut her own floatation and to work alongside quay walls, dredging to a depth of 48ft. below the water level. The buckets have a capacity of 21 cubic feet each and are designed to give an output of 750 tons per hour. The power is furnished by a triple-expansion steam engine, working at 180 lb. pressure, the steam being supplied by a return-tube marine boiler. Special features include steam mooring winches, both fore and aft, for handling the heavy dredging chains, and steam winches for the raising and lowering of the bucket ladder and the side chutes. A 7-ton crane is fitted for raising the bottom tumbler and buckets should renewals or repairs be required. The bottom tumbler is also fitted with the firm's patented lubricating device. On the dredger "Telford" it was found that there was no appreciable wear on the bottom tumbler shaft fitted with the lubricating device after dredging over 3 million tons of material. Messrs. Lobnitz also completed several other sets of rock-cutting equipment and pontoons.

At the yard of William Simons and Co., Ltd., Renfrew, one small non-propelling bucket dredger was completed for British owners and a 954-ton dredger with machinery of 850 I.H.P. was finished for colonial service. A barge-loading bucket dredger, the "Barao de Maua," was built for the Government of the State of Pernambuco, Brazil. This dredger is designed to deal with all classes of material and to dredge to a depth of 46ft. below water level. The machinery comprises a set of triple-expansion engines and two 160 lb. pressure multi-tubular boilers. Provision is made for two bucket speeds, so that when working in either hard or soft ground a constant piston speed may be maintained.

At Paisley, Fleming and Ferguson, Ltd., completed a 1933-ton bucket dredger, the "Otakon," for service in Port Chalmers, New Zealand. She has 1800 I.H.P. machinery and a Babcock and Wilcox water-tube boiler is fitted. At the same yard the dredger "Thomas Downie" was finished for Karachi. She is an 850-ton dredger with 850 I.H.P. machinery. Four other dredgers were delivered for service in the Malay States.

(To be continued.)

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

THE IRON AND STEEL INSTITUTE.

SIR,—This is the season for the making of New Year's Resolutions, and I venture to make the following suggestion to the readers of your valuable publication. For my purpose I divide your readers into two categories: (*a*) Members of the Iron and Steel Institute, and (*b*) non-members. To the former I say "Resolved: That I will obtain at least one new member for the Iron and Steel Institute during the coming year." To the latter I say "Resolved: That I will take up membership of the Institute with the utmost despatch."

That the Institute has laboured long and arduously for the benefit of both the iron and steel manufacturers *and* the users is beyond dispute; nevertheless, individuals cannot be expected to become members simply from a sense of altruism. What, then, are the benefits to be derived from membership? The Institute is bound by its constitution to hold at least two principal meetings in the year. In addition, the Council may authorise further meetings to be arranged. Last year, besides the general meetings in London and Newcastle, four additional meetings were held in Glasgow, Sheffield, Scunthorpe and Birmingham respectively. The reading and discussion of papers at these meetings is, of course, an important part of the proceedings, but there is another equally important, though more personal and less formal, aspect of these functions. Members have an opportunity to "get together" and discuss their own troubles and difficulties. Therein lies a special interest for the steel users, and the Council are especially anxious that the number of users, particularly those engaged in the further treatment of steel, on the roll of the Institute should be considerably increased. If the British engineering and iron and steel industries are to advance and compete successfully with their competitors under present-day conditions, they must throw their various experiences and knowledge into the common pool—the Iron and Steel Institute affords the means for this.

Another asset of membership is the Library of the Institute. It may be fairly claimed without exaggeration that the Library is the finest specialised collection of literature on iron and steel technology and allied subjects in the kingdom. Members may consult text-books, volumes and periodicals in the Reading Room, or may borrow them on the simplest of conditions imaginable. Members are notified at intervals, on request, of all recent additions to the Library. A "Library Service" has been in operation for some years now, and the number of requests for information and for references to the literature on the most varied subjects is steadily increasing.

It only remains for the resources of the Institute to be augmented for it to become of even greater assistance to the industries which it serves than it has been in the past.

G. C. LLOYD,
Secretary.

London, January 1st.

The Electricity Commissioners' Annual Report.

THE ninth annual report of the Electricity Commissioners, covering the year April 1st, 1928, to March 31st, 1929, states that the principal feature of the period reviewed was the great progress made in the preparation and carrying out of the new regional schemes for the co-ordinated development of generation and main transmission in accordance with the policy of the Electricity (Supply) Act, 1926. Three further regional schemes prepared by the Commissioners for Central England, for North-West England and North Wales, and for Mid-East England respectively, were adopted with certain modifications by the Central Electricity Board. The five schemes in all which have been adopted by the end of March, 1929, cover about 43 per cent. of the total area, and as much as 75 per cent. of the total population of Great Britain, and embrace the areas of supply of some 450 authorised undertakers whose operations accounted for upwards of 80 per cent. of the total sales of electricity to consumers in Great Britain in 1927–28. The total value of the contracts placed by the Central Board at March 31st, 1929, in respect of primary and secondary transmission lines, associated transforming stations, and other works, amounted to approximately £8,150,000. The problems of distribution, particularly in relation to the extension of electricity supply into rural areas, also received considerable attention during the year.

Inclusive of the Central Electricity Board, and allowing for the cases of two companies with undertakings in England and Scotland, the number of separate undertakers at March 31st, 1929, was 659, a net addition of 17 to the number holding supply powers at the end of the preceding year. There were also five other statutory bodies not possessing powers to supply, but charged with definite duties of an advisory or supervisory character in respect of the organisation for the supply of electricity in districts within their jurisdiction.

The units generated showed an increase of upwards of 9·5 per cent. on the figures for 1927–28, the larger output being obtained by an increase of only 3·7 per cent. in the amount of coal and coke consumed. There was also a reduction of about 4800 tons in the amount of oil fuel used at generating stations as compared with the previous year. The preceding figures and those given in prior reports show that the production of electricity at the stations included within the scope of the returns has increased by upwards of 110 per cent. since 1920–21, representing an average increase in the neighbourhood of 13·8 per cent. per annum during the past eight years, notwithstanding the fluctuating conditions of trade and industry during that period. They also show that there has been an all-round increase of the order of 60 per cent. in the amount of electricity produced per ton of coal and coke consumed for that purpose, as compared with 1920–21.

There was an increase of nearly 11 per cent. in the sales of electricity by authorised undertakers, as compared with the figures for 1927, and a total increase of over 108 per cent. during the six years since 1922, or an average of 18 per cent. per annum. On the basis of the estimated total population of Great Britain at the end of 1928, namely, 44·37 millions, the sales of electricity from public sources of supply in that year represented an average consumption of 171 units per head of population. It is of interest to record that the curve of estimated growth in the output of electricity during the years up to 1933–34 and thereafter up to 1940–41, which was prepared by the Commissioners as a preliminary to the formulation of the new regional schemes, forecasted the sale of about 7500 million units of electricity to consumers in 1928, as compared with the realised sale of 7603 million units.

The aggregate capacity of the generating plant for new stations and extensions of existing stations sanctioned by the Commissioners during the year 1928–29 amounted to 602,818 kilowatts, as compared with 668,357 kilowatts in the preceding year. The amount of plant sanctioned for initial installation in new generating stations was considerably less than in the previous year, but the amount sanctioned for extensions of existing stations was greater by about 62,000 kilowatts. Of the generating plant sanctioned during the past nine years, approximately 59·8 per cent. was for stations belonging to public authority undertakers; about 30 per cent. for stations for company undertakers; and the remaining 7·2 per cent. for stations owned by railway and tramway authorities and non-statutory undertakings. During the year ending March 31st, 1929, the Commissioners issued twelve consents—six to authorised undertakers, five to non-statutory undertakings, and one to a railway company—in respect of the establishment of new generating stations, representing the initial installation of plant having a total rated capacity of 119,250 kW. The three principal consents were concerned with stations for use in connection with the regional schemes of the Central Electricity Board, two of the consents authorising the erection of new "selected" stations with initial capacities of 50,000 kW in each instance.

SIXTY YEARS AGO.

JUST as we do to-day, so, too, in our issue of January 7th, 1870, we passed in review the chief features of the engineering history of the year that had just closed. For four years the country had been suffering from a commercial and professional stagnation and depression, unprecedented in its annals. In 1869 there had been flickering signs of returning confidence and prosperity, but the financial disasters and mishaps of 1866, 1867, and 1868 had made people cautious and suspicious, even of indubitably sound and honourable investments. In such an atmosphere, the engineer could find little fresh opportunity for the exercise of his creative talents. The year's record was one less of fresh undertakings than of the progress or completion of works previously begun. The most notable event in the world of civil engineering which we had to record was the opening of the Suez Canal. Monsieur de Lesseps' success, we noted, had already incited others to like exertions, and various schemes of canalisation were being carried out or planned in several parts of the world. Dr. Cullen, we wrote, was labouring to cut a ship canal through the Isthmus of Darien, there was talk of another canal through the Isthmus of Corinth, and in Holland a very fine piece of canal work was being carried out. We were sceptical of the commercial success of the Darien Canal, for we believed that the Atlantic and Pacific Railway recently completed in the United States—one of the greatest engineering achievements of the age, so we described it—would attract the traffic. The completion of that railway had inspired thoughts of other similar lines. There was talk, we noted, of constructing a transcontinental railway in Canada, and others would doubtlessly follow just as the laying of a British Atlantic cable "with enormous difficulty and at fabulous expense" had been followed by the laying of a very successful French cable. Continuing our survey of the year's events, we noted the introduction on American railways by Messrs. Pullman of sleeping and other cars designed to make bearable journeys of enormous length. We had much to say concerning sewage disposal in this country. The favourite watering-place, Hastings, had been drained by the simple expedient of turning all the sewage into the sea at a point remote from the town. We did not commend this solution of the problem, but looked hopefully to the extension of the profitable practice of sewage irrigation as carried out at Croydon, the Lodge Farm, Rugby, and Norwood. Of bridges, we spoke in high terms of that at Blackfriars, which had been opened during the year. Concerning railways, we recorded some extensions of the local systems of London, the near approach to completion of the Midland Company's imposing St. Pancras Station, and the reconstruction in iron of the timber roof of King's Cross Station. In the field of marine engineering and naval architecture, the principal feature of the year was the tendency manifested among shipowners to adopt increased lengths for their vessels. On the Mersey an active business was being done, cutting vessels into two and lengthening them. Surface condensation, compound engines, and high pressures were coming into favour with enterprising owners. Nearly all the ships that were being altered would be fitted with compound engines using steam at the "very high pressure" of 80 lb. Electricity, we noted in conclusion, was no longer regarded as a "subtle agency." Thanks to the labours chiefly of Mr. Latimer Clark and Professor Sir W. Thomson, the ohm, the volt, and the farad had been established as accurate measures. Telegraphists had become scientific men and electricity had passed from the stage of empiricism into an exact science.

Obituary.

LIEUT.-COLONEL MONTAGU CRADOCK.

THE death is announced, at the age of seventy, of Lieut.-Colonel Montagu Cradock, C.B., C.M.G., who was associated as a Director with the Metropolitan-Vickers Electrical Company, Ltd., since its early days in 1902. Popularly known as "The Colonel," he endeared himself to everybody connected with the company, staff and workpeople, by the unfailing interest he always showed in their welfare.

Beginning his military career in the Durham Fusilier Militia in 1877, Colonel Cradock served through the Afghan campaign, commanded the 2nd New Zealand Contingent, and later the 3rd Mounted Infantry Corps, and the Bushmen's Brigade in the South African War, and in August, 1914, raised the 2nd King Edward's Horse, and commanded that unit until he retired in August, 1918.

THE use of carbon dioxide as a blasting agent is made possible by first liquefying it under pressure and then charging it into a hollow steel cylinder the outside diameter of which is 3in. and length nearly 32in. Suitable means are provided for sealing the cylinder, which holds the liquid, with a mild steel disc. The new model shell, after having been charged, is placed in the bore-hole in the coal. The bore-hole is tamped with incombustible stemming in a manner similar to that employed with permissible explosives. The liquid carbon dioxide within the cylinder is gasified by means of a heating element, which is immersed centrally within the liquid. This element consists of a combustible mixture of powdered solids with an electric squid embedded therein. Wires which extend from the shell to the outside of the bore-hole are connected by leading wires to a single-shot permissible blasting unit. The squid is ignited by operating the blasting unit. This, in turn, ignites the combustible mixture of the heater element. The temperature of the liquid carbon dioxide is raised above its critical temperature, so that it is changed to a gas. This change causes a very rapid increase in pressure of the gas within the shell that causes the steel disc to be sheared. The gasified carbon dioxide expands and rushes through the aperture sheared in the steel disc. Pressure is then built up in the bore-hole that causes a rupture of its walls, thus bringing down the coal.

Railway and Road Matters.

CONSIDERABLE interest has been taken—by the old as well as the young—in an exhibit of signalling and safety appliances which the Underground people have installed at Charing Cross.

THE construction of the new passenger station of the Baltimore and Ohio Railway will involve the moving of 6,000,000 cubic yards of dirt. The total cost of the scheme will be about £41,000,000.

ONE of the latest units on a railway to be constructed of reinforced concrete instead of timber is a 20-tons goods brake-van on the London and North-Eastern. The framework must, however, be heavier than one of timber, as it is claimed that the cast iron blocks carried under the floor of the van to give it the necessary braking weight are not necessary.

THE Bakerloo train which left Queen's Park for Elephant and Castle at 12.15 a.m. on the morning of Wednesday last was the last of the iron gate trains to be run on the tube lines, after having completed over 1,000,000 car miles. Three years ago the replacement of the whole of the original cars commenced. December 31st saw the completion of this programme, 191 new trains, composed of 1219 individual cars, having by then been put into service at a cost of nearly £5,000,000.

WITH paint on passenger coaches blistered and charred holes in the roofing, a passenger train on the Hudson Bay extension of the Canadian National limped into The Pas, Man., recently. It had, says the *Railway Age*, successfully run the gauntlet through 3 miles of smoke and flames of a forest fire. Before taking the plunge, the train stopped and the crew reconnoitred. The passengers were eager to get through. It was decided to make the dash. Once through the furnace of blazing timber, the train again stopped and the crew cleared the roofs of the cars of flaming sticks and put out several small fires.

CHANGES of importance are being made in the administration of the London, Midland and Scottish Railway. Mr. F. G. Evans, who has successively been audit accountant, chief stores superintendent, secretary, and who, a year ago, was made a vice-president, has retired. Mr. J. Quirey, also an accountant by profession, the vice-president of the finance and service departments, is transferred to the position held by Mr. Evans as one of the two vice-presidents for the railway traffic operating and commercial section, and Mr. W. V. Woods—yet another accountant by profession—now controller of costs and statistics, succeeds Mr. Wood in his vice-presidency. Mr. J. F. Gee, the chief accountant to the company, retires, and is followed by Mr. Ernest Taylor.

THE Ministry of Transport railway statistics for September have recently been issued as a Stationery Office publication, price 3s. 6d. They show that, compared with September, 1928, there was an increase of 2·4 per cent. in the number of passenger journeys, but the receipts from passengers fell by 3·6 per cent. That was due to 4,384,376 more passengers travelling at reduced fares, and 1,982,349 fewer paying their full ordinary fare. Moreover, the larger number of passengers led to an increase of 1·4 per cent. in the passenger train-mileage. On the other hand, the tonnage of freight increased by 9·6 per cent.—accounted for mainly by a rise of 11·7 per cent. in the coal traffic—and the freight receipts increased by 4·4 per cent. The freight train-mileage had a corresponding advance of 3·9 per cent. The average train load rose from 130 to 132 tons, and the net ton-miles per engine-hour from 452½ to 457¼.

THE Ministry of Transport railway statistics for September also contained the results for the first nine months of the year, as compared with the corresponding period of 1928. They also show that the number of passenger journeys increased by 3·2 per cent., but owing to the great decrease in the number who paid full fares, the receipts from passengers fell 3·4 per cent. There was, however, an increase of 1·1 per cent. in the receipts from parcels, and so the fall in passenger traffic generally was 2·5 per cent. The increase in passengers led to a rise of 2·2 per cent. in passenger train mileage. Freight traffic was, however, better, as it increased 7·4 per cent. in tonnage and 3·5 per cent. in receipts. That, mainly, was due to the traffic in coal, coke and patent fuel, which advanced 10·5 per cent. in tonnage and 9·7 per cent. in receipts. General merchandise had an increase of only 0·9 per cent. in tonnage and a decrease of 1 per cent. in receipts. The greater coal traffic led to 3 per cent. more freight train-miles and to an increase of 3 per cent. also in the average train load.

THE Wimbledon and Sutton Railway, which will be opened throughout on Sunday next, January 5th, has had a varied history. It was originally privately promoted and sanctioned in 1910, but practically nothing was heard of it until the City and South London Company wanted, in 1923, powers to extend its system from the terminus at Clapham Common to the proposed Wimbledon and Sutton Railway. The latter line was, it may be noted, "fathered" by the Metropolitan District Company, as its trains were to run over the line from the London and South-Western at Wimbledon, and the new railway was to be worked by the District. The Southern Railway had come into being by 1923, and it opposed the City and South London proposals as exceeding the limits of the facilities that tube railways were expected to provide. The Southern had no objection to the City and South London extending its line to Tooting, and said that if the Wimbledon and Sutton formed the ground for any further extension the Southern would solve the problem by taking over the Sutton Railway. Eventually it was agreed that the tube should be extended to and end at Morden, and that the Southern should acquire the Wimbledon and Sutton. The City and South London Bill was amended accordingly and passed in 1923, and the extension was opened on September 13th, 1926. The Southern had to wait until the following session for powers to acquire the Wimbledon and Sutton, and the line was then designed to leave Wimbledon Station on the southern side independently of the District trains, which use the northern side, and to run into the Southern station at Sutton instead of having a station of its own there.

Notes and Memoranda.

ALTHOUGH it has now been "blowing" for some fifty years, there is still a steady flow of almost pure methane gas, at the rate of 800 cubic feet per hour, from one of the Porth, Glamorganshire, coal pits. The gas is 97·19 per cent. pure.

ONE of the outstanding gold mines in the Kirkland Lake District of Ontario, Canada, is the Teck-Hughes Mine, which during the past year produced gold to the value of over £978,000. Eleven years ago the annual production of gold from this mine was only £30,000, but since then it has steadily increased every year, with one small exception.

AN apparatus recently developed by the Kaiser Wilhelm Institut für Eisenforschung and given the name of the "Farbpyroversum," is a simplified pyrometer for furnace work. It consists of a window made up of a red and a green disc. The intensity of the colours are chosen in accordance with the temperature of the furnace it is desired to maintain. In working, the window appears of a greyish tint at the correct temperature. If the temperature is too high the green shows up and if too low the red.

LAST year the Fagersta Works in Sweden installed a Flodin furnace for the manufacture of steel directly from iron ore. The chief engineer now reports that the experiment, which was on a large scale, has turned out well. The plant operates without any trouble, and the process has proved serviceable in actual working. The quality of the steel obtained is also good. The consumption of charcoal is stated to be about one-half of the quantity consumed in blast-furnaces, and the consumption of electric current no higher than for the manufacture of electric pig iron.

IN some investigations as to the fire resistance of plaster partitions carried out by the American Bureau of Standards it was found that an appreciable gain in fire resistance is secured by increasing the gypsum content of the plaster from the 1 : 3 to the 1 : 2 proportion. The gypsum in the plaster aids materially in retarding the temperature rise in the partition, since the hydrated plaster, $CaSO_4 \cdot 2H_2O$, is changed by loss of combined water to $CaSO_4 \cdot \frac{1}{2}H_2O$ (plaster of Paris) or $CaSO_4$, depending on the temperature. This molecular change absorbs heat and the vaporisation of the water set free further retards the temperature rise, particularly above 100 deg. Cent. (212 deg. Fah.).

THE added hazards to mining, incident to oil and gas wells penetrating the coal measures in proximity to mine workings, have long been recognised in those American fields where the extraction of oil, gas, and coal has been in progress for a number of years. The history of these fields is replete with stories of serious mine fires, explosions, and miraculous escapes from both fires and explosions caused by either oil or gas finding its way into the mine workings through the strata, or by mining into an unknown or uncharted and abandoned oil or gas well that had not been properly plugged. As a consequence, coal mines being worked under such conditions are now classed as "gassy" mines, regardless of their inherent qualities.

IT is reported in the *Chemical Trade Journal* that Professor E. von Szarvasy, of the Budapest Technical High School, has perfected a new process of bauxite treatment which consists essentially in subjecting the crude mineral to the action of chlorine gas. The product obtained is stated to be not only capable of being more readily worked up into aluminium metal than the crude bauxite, but to effect a considerable saving in transport charges. The well-known bauxite deposits in the Bakonyer district of Austria are at present exploited by a German group, and, with the exception of what is used for the manufacture of bauxite cement, is entirely exported. The Hungarian Government has renewed its agreement with the German group, with the stipulation, however, that one-third of the output must, if required, be at the disposal of Hungarian industry.

THE plan which at present appears to American astronomers to be the most promising for the manufacture of the mirror for the proposed 200in. reflecting telescope to be installed in California, is to make the mirror of fused quartz, a substance which possesses a very small temperature coefficient. The process consists of fusing a mass of nearly pure silica in a circular electric furnace which constitutes the mould. The disc thus obtained contains a large number of small bubbles, but it can be ground to the approximate curvature of the mirror desired and then coated to a sufficient thickness with perfectly transparent quartz free from bubbles. The final figuring is then carried out on the surface of this clear layer. The quartz composing the clear layer is sprayed on to the hot disc by means of multiple oxy-hydrogen burners. A 22in. disc has already been constructed in this way, and it is now proposed to make a 60in. mirror before finally embarking on the construction of the 200in. mirror itself.

LATE one night this week important tests were carried out in order to investigate numerous complaints respecting the new twin-programmes which the B.B.C. commenced broadcasting from Brookman's Park less than a month ago. This system of broadcasting is to be adopted at the new big regional stations planned for other parts of the country, and it was essential to discover the conditions of reception. Mr. L. McMichael undertook the tests on his four-valve portable and was accompanied by another wireless authority and an official of the Radio Manufacturers' Association. The tests were designed to discover how near to Brookman's Park it is possible to get and still be able to separate the two programmes which, the complaints alleged, came over confused and clashing with each other. The party started testing by the roadside in various parts of North London and Hertfordshire at 11.40 p.m. and continued until midnight. At every point the experts succeeded in getting perfect reception, and were able to separate the two programmes with ease. The last halt was made at the gates of Brookman's Park, when not only were the twin programmes separated and heard clearly, but several continental stations, including Berlin and the Eiffel Tower, were received. The tests proved that the twin programmes are easily obtainable on the right kind of set, and therefore there is no necessity for the B.B.C. to make any alteration in the system to be used at their new stations to be erected at Slaithwaite for the North, Larbert for Scotland, and Bristol for the West Country.

Miscellanea.

AN All-British Exhibition is to be held in Buenos Aires from February 18th to April 2nd, 1931.

IT is said that the output of metallic lithium from the German works at Langelsheim is some thousands of kilogrammes a year.

A DOUBLE line of 16in. gas main nearly a third of a mile long has been laid in the bed of the river Rhine in connection with the supply of Ruhr coal gas to Cologne.

THE first helicogyre flying machine to be built in this country is, according to the *Daily Telegraph*, nearly ready for flight at the East Cowes works of Saunders-Roe, Ltd.

IT is said that the demand for space at the forthcoming British Industries Fair, at Birmingham, has been so great that it is now difficult to find accommodation for another stand.

THE Miners' Phthisis Board of South Africa has an annual expenditure in respect of benefits of about a million a year. The cost of administration is about 1·8 per cent. of the amount distributed.

THE coal pits of the Dominion Coal Company, Nova Scotia, are being completely equipped with electric machinery in place of the present steam plant. The power is to be provided by a pulverised coal plant on the shore of Glace Bay Lake.

THE British Cast Iron Research Association has just issued a report, of some sixteen pages, dealing with recommended methods for sampling and the analysis of foundry materials. It may be obtained from the Association at 24 St. Paul's-square, Birmingham, price 10s. 6d. net.

A CONTRACT for the development of the Narva waterfalls in Finland has been secured by the English company known as the International Hydro-Electric Syndicate, in competition with German and American firms. The plant is to have a capacity of 50,000 kilowatts, and will cost 30 million kroner.

THE directors of Low-Temperature Carbonisation, Ltd., state that the plant at the Barugh works has been in constant operation. The total amount of coal actually carbonised from the commencement up to October 31st was 136,720 tons. The chief products obtained were approximately as follows:—Coalite smokeless fuel, 95,704 tons; crude coal oil 2,324,240 gallons; coal petrol, 273,440 gallons.

THE Sodalumina Chemical Corporation of Canada is negotiating for a site at New Glasgow, N.S., where it will establish a chemical plant to utilise large deposits of clay for the manufacture of alumina. The process is, says the *Chemical Trade Journal*, to produce soda ash, silica, alumina and hydrochloric acid from clay, salt, and coal. Mineral rights are held by the company on the Abercrombie clay deposits near New Glasgow. Sufficient capital has been subscribed in Ottawa to promote the development.

IT is reported from Gibraltar that Colonel Jevenois, the author of the scheme for the tunnel under the Straits of Gibraltar to link up Europe and Africa, arrived at Tarifa from Madrid on December 26th accompanied by a number of engineers. He inspected and passed the plans for the work, which will be carried out next year. Colonel Jevenois stated that the Spanish Government had now approved a new grant to defray the cost of taking soundings and sinking shafts. The work would begin this month at Alcazar Seguir, in Spanish Morocco, opposite Tarifa, where it is proposed that the African end of the tunnel should be situated.

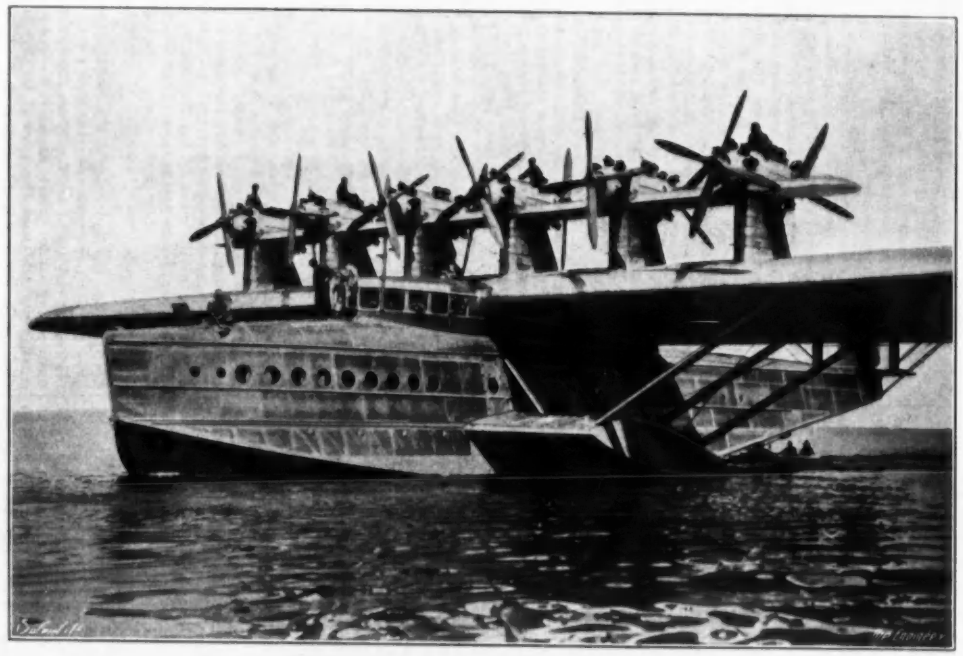
THE new eighteen-passenger Boeing airplanes built for passenger service between San Francisco and Chicago have a gross weight, loaded, of 8½ tons, and the landing gear has been designed to sustain that weight with a safety factor of five. The American Department of Commerce regulations require that the design of such machines shall provide for a landing factor involving an 18in. drop, which is considerably more than should be involved in normal landings. As a safety measure, however, the new Boeing plane is designed to withstand a landing shock of 87,500 lb., calculated as the equivalent of a 23in. drop. The tires have, according to the *Engineering News-Record*, a height of 4½ft. and a width of 1ft. Each wheel is provided with a heavy shock-absorbing device operating on the dashpot principle.

SOME days ago Sir William Mitchell-Thomson asked the Postmaster-General if he would state what call-sign was being allocated to the second station at Brookman's Park; and when it was anticipated that a full alternative programme would be transmitted from that station. Mr. Lees-Smith said that it had been agreed that for the time being the London call-sign "2LO" should cover both transmitters at the Brookman's Park station. When two programmes were transmitted simultaneously, they would be referred to as "London Regional" and "London National" respectively. The tests which were now being carried out in the transmission of alternative programmes for short periods would be continued for some weeks; but the British Broadcasting Corporation was not yet able to state the date on which it expected to be in a position to transmit full alternative programmes from the station.

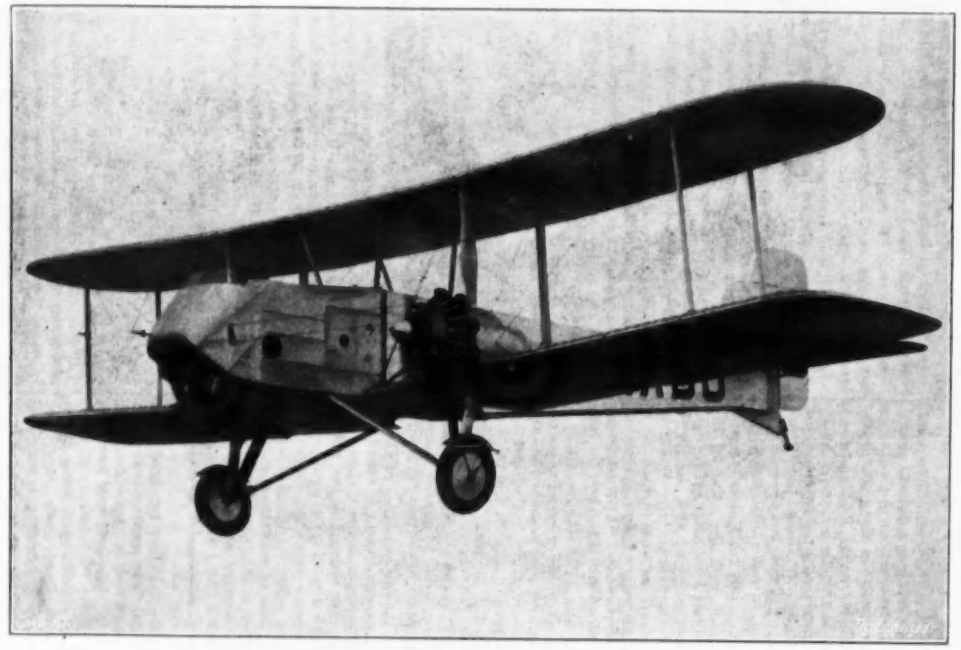
SOME day, states the *Electrical Times*, a book ought to be written upon the applications of electricity in navigation. A mere catalogue of electrical service at sea would be an impressive document—more extensive and more varied than most of us, who live too close to our work to see it in general perspective, perhaps realise. It was on board ship that most of our manufacturing firms, in the lean years before the passing of the Electric Lighting Act, 1888, found their best market. Sea travel introduced thousands to the amenities of electric light; the voyage through the Suez Canal afforded a picturesque function for the arc lamp; the ventilation of cabins gave the electric fan a valuable field; and from these beginnings the use of electricity on board ship extended, until to-day a liner carries as much generating plant as a small town and uses the current for lighting, heating, cooking, power, communication and other purposes with a thoroughness which E.D.A. would like to see paralleled on shore.

SOME AIRCRAFT OF 1929

(*For description see page* 18).



DORNIER TWELVE-ENGINED FLYING BOAT



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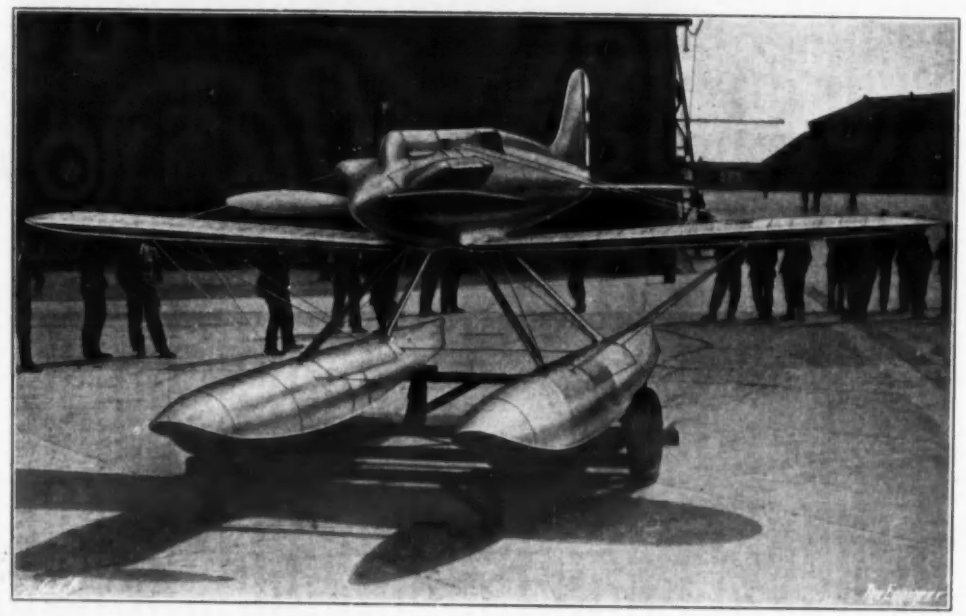

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TWO FOUR-PAGE SUPPLEMENTS—SOME POWER STATIONS, STEAMSHIPS, MOTOR SHIPS, AIRSHIPS, LOCOMOTIVES, AND CIVIL ENGINEERING WORKS OF 1929.

NOTICES TO READERS.

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DEATH.

ON December 29th, ALFRED T. JENKINS, J.P., chairman of Robert Jenkins and Co., Ltd., of Rotherham, in his seventy-eighth year.

THE ENGINEER.

JANUARY 3, 1930.

1929—A Retrospect.

VERY early in June the Conservative Government went out of power and was succeeded by a Labour Government. Even warm supporters of Mr. Baldwin were not sorry for the change. The country had not recovered from its troubles under his Ministry, industries were still in a backward state, and unemployment stood at a high figure. He was charged with practising a *laissez faire* policy, and it was hoped that Labour, which came in with many promises of activity and reform, would bring new energy to the task and solve the industrial problems of the kingdom. It has now been in office for six months and has effected nothing. Unemployment is at least as high as ever, and industry as a whole is no better. No new policy for improving the industrial welfare of the country has been introduced, or even foreshadowed. We are exactly where we were when the late Government went out of power, with one exception. Mr. Baldwin made an effort to help industry by reducing the burden of taxation which it has to bear. His de-rating Act may not mean much, but at any rate it tended in the right direction. Mr. MacDonald's Government has not only made no effort to reduce the costs of manufacture, but by the inevitable increase of taxation to meet new measures it threatens to raise them and so make competition with foreign rivals more difficult than ever. Moreover, the Government is a Free Trade Government and has asserted its intention of putting its principles into practice. The position is, therefore, a particularly unpleasant one, for whilst manufacturers foresee an augmentation of imposts, they may find themselves deprived of the protection given by the McKenna duties and, probably, other safeguarding measures.

Labour and Socialist members in the House of Commons, whilst in opposition, arraigned the Conservative Government for its inability to deal with the problem of the unemployed. They went still further, for they gave it to be understood that once they came into power the difficulties would dissolve and the whole country would be profitably employed. Anyone who has studied this subject knew full well that such promises could not be fulfilled ; yet even they hoped against hope that the new Government had some secret nostrum for the cure of the greatest malady of the country. But as the months have followed upon each other's heels, unemployment has grown rather than diminished, and the principal spokesmen of the Cabinet have, at length, had to admit that no solution has been found. Mr. MacDonald and Mr. Thomas, the specially appointed "Minister for Unemployment," have failed as completely as their predecessors, and we may exclaim with Thersites, "If Troy be not taken till these two undermine it, the walls will stand till they fall of themselves." The fact is, of course, that there is only one solution—improved trade—and it the present Government has done nothing whatever to encourage. The crying necessity of trade is the reduction in the costs of manufacture, and no Government will succeed in effecting the absorption of a material part of the million or more persons who are now out of work until it risks unpopularity with a large section of the electorate and faces that fact fearlessly. It may mean the reduction of our social services, the heavy pruning of the Civil Service, the increase of the hours of labour, the reduction of wages in sheltered industries, and various other measures which only a wise and daring statesman could devise. We are attempting to do much more than any other country in the same circumstances would attempt and we are failing. We are endeavouring to live at ease when we have but enough for existence. Instead of distributing money through productive industries which add to the wealth of the nation, we are frittering it away, bit by bit, on doles, or taking up the burdens which the individuals themselves should, and could, bear were they "gainfully employed."

Heavy taxation, especially excessive direct taxation, besides hampering industry directly, has bad psychological effects. A common difficulty in the application of certain forms of the premium bonus plan is that the workmen hold that they should receive all the profits on their increased output—not share it with their employers. Even though they stand to gain themselves, they often reject the plan because part of the saving is withheld. Heavy direct taxation is akin to this condition. No man feels the same incentive to earn when he knows that a substantial fraction of his earnings will be taken from him. Indirect taxation has not the same psychological effect because the purchaser of taxed goods always feels that it is his affair whether he pays the price or not. He can go without the article if he cannot afford it. There is yet another dangerous effect of heavy taxation of any kind. Those who have been well-to-do and find themselves more or less impoverished are easily tempted to embark upon "get-rich-quick" schemes and money is, in consequence, expended, not upon sound industrial enterprises, but upon those in which the oscillations of the share market, rather than the production of useful commodities, are the prime consideration.

Empire Trade.

But if the Government has failed to produce a single scheme which will materially reduce unemployment or encourage industry, the country, as a whole, has been turning its eyes in the direction from which salvation may come. A British Empire co-ordinated for the industrial benefit of all its parts is no new idea. It has been discussed for many years past, but never with so much energy as in the year which has just closed. We are not—not yet at least—concerned with details of the schemes which have been advanced. If once agreement on the principle can be secured it should not be beyond the capacity of politicians and economists to evolve a working plan. The essential thing at the moment is to secure adherence to the doctrine that a United Empire, an Empire of which all the parts are allied in a trade brotherhood for the good of all, is desirable. Up to the present the Dominions have shown little interest in this principle, and one of them, Australia, has acted in opposition to it by the imposition of still higher import duties. But the Imperial Conference opens in a few weeks, and if it does not lead to the adoption of a substantive plan for fostering Empire trade, it may be hoped, that sympathy, which will mature in the course of time, will be enlisted. When the vast resources of the Empire are borne in mind, when it is remem-

bered that it might be a self-sustaining unit, when the benefit to all parts that would result from complete industrial co-operation are considered, it is not too much to hope that sooner or later a United Empire will be brought into happy and prosperous existence.

Industrial Progress.

Regarded from the technical aspect, the year was one of some encouragement. Much money was not made in the engineering and its allied industries, but a great deal of good work was done, and in the field which is now covered by the general description Electrical Engineering, there was great activity. It is sometimes necessary to remind ourselves that electrical engineering is, fundamentally, mechanical engineering, and that many of the great electrical firms are builders of turbines and condensing plant as well as alternators, transformers, switchgear, and many other things which are essentially electrical. There are, of course, many cases in which the electrical plant is made by one firm and the turbines by another; but when we are considering the condition of mechanical engineering in Great Britain we must not forget that the electrical firms are doing a great deal of it. Hence it is that the fullest account of the development of turbine machinery during 1929 will be found in our Annual Review of Electrical Engineering. It is only necessary to glance through that review to feel, at once, that the engineering industries of this country are, in one department at least, in an excellent position. A quite astonishing amount of work was done, contracts came from all parts of the world, and there was continual advancement in capacity and efficiency. There is, here, not a trace of the backwardness with which British engineers are sometimes charged, and we can give no better advice to the doubter than to read the long story of our accomplishments in the year that has just ended.

The rapid progress of the "grid" is very largely responsible for the amount of work finished or in hand. It has many critics; it is doubtful indeed that it will reduce the cost of electricity; it is costing an enormous sum of money; but, it is giving a great deal of employment, and—a very important thing—it is giving British manufacturers the means and the opportunities for the pursuit of new inventions and the development of research. What competitive warship building did for British engineering in all its branches can never be estimated. We may, however, say with no hesitation that without the stimulation which it provided, the contribution of engineering to the peaceful arts would have been far, far less than it has been. The "grid" is now serving the same purpose, and in a sense has taken the place of warship construction. It is encouraging enterprise, giving cause for the development of new inventions, and leading manufacturers to embark upon investigations and researches which, for lack of the call and the means, would otherwise have been neglected. The good of such work does not end with the purpose for which it is carried out. The knowledge and experience that are gained can be applied in other directions and the fruits are gathered in the markets of the world.

Locomotives and Airships.

In another branch of mechanical engineering we welcome a newcomer with both hands. Sometimes we have felt it our duty to animadvert upon the influence which foreign inventions were having upon the steam locomotive. We regretted that a machine British in origin and development should not retain national characteristics, and we urged our Chief Mechanical Engineers to see what they could do for themselves. We like to flatter ourselves that our words have been taken to heart, but whether we may do so justly or not, we are indeed delighted that a really new design of steam locomotive which has been invented and made by British engineers and owes nothing to the foreigner was completed towards the end of the year. No one yet knows whether it will be successful or not; every new machine is subject to doubt till it has been tried. But when as sound a locomotive engineer as Mr. H. N. Gresley, and as experienced a boiler designer as Mr. Harold Yarrow, put their heads together, the probability of success is, to say the least of it, high. Photographs of this notable engine are reproduced in one of our Supplements to-day, and particulars are given upon another page, but the technical interest of the design, which resides chiefly in the boiler, will be better appreciated when we are able to give, as we hope to do before many weeks, a general arrangement.

It is no more than a coincidence, but a happy and, let us trust, a propitious one, that the appearance of a new type of British locomotive should coincide with the centenary of the most famous locomotive in the world, Stephenson's "Rocket." In October, 1829, the trials which settled once and for all the future of railways were held at Rainhill, and, as everyone knows, the "Rocket" carried off the prize and established principles of locomotive design which have held up to the present day. There was no celebration of this centenary, save a local one, but a perfect copy of the original engine was made by the successors of the original builders for Mr. Henry Ford's museum at Detroit. This wonderful reproduction is as faithful to the "Rocket" itself as research could make it. Infinite pains were spent upon every detail, and it is almost certain that the problem of the fire-box, which has long vexed historians, has been solved.

We must not close these references to the locomotive work of the year without expressing our pleasure that Kitson and Co., Ltd., have been able to pursue their experiments with the Kitson-Still engine, and that success seems to be well within sight. Everyone who knows the difficulties, disappointments, and discouragement which have to be faced in the development of novel mechanism will join with us in congratulating the company on the courage and pertinacity which it has displayed.

In the field of transport the completion of the two great airships "R 100" and "R 101" was a very notable event of the year. Whilst we have never taken kindly to the airship and have held that the cost of construction could be more profitably expended upon the development of heavier-than-air machines, we cannot withhold our admiration of the wonderful engineering and metallurgical skill and science which have been devoted to the construction of these vast fabrics. The tree of knowledge is never fruitless. The experience gained in the construction of these light frameworks will, we are confident, be turned in the course of time in other directions, where an extended, and possibly a more profitable use for it will be found.

Thames Bridges.

When we reflect upon the seemingly interminable discussion of the Waterloo and Charing Cross bridges, we find ourselves upon the point of wishing that a dictator would rise in our midst and put an end to the never-ceasing stream of objections and reconsiderations. It is understood that a decision with regard to Waterloo Bridge has been reached; but so far nothing has been done. The wooden false-work and the temporary steel bridge stand where they did, and both may subside into the bed of the river before steps are taken to rebuild the defective piers and to widen the roadway. Were it not that even the hardiest would be appalled by such a disaster, we might be tempted to imagine that those who have no reverence for the old structure are delaying activity until it is past redemption! But if something has, at least, been settled about Waterloo Bridge, there are reasons for fearing that the whole problem of Charing Cross Bridge and the river improvement scheme upon the south bank is again in the melting pot. The scheme which was approved—or almost approved, should we say—is not perfect, but if we go on waiting till an arrangement to which no objection is possible is found, the bridge will remain as it is, a disgrace to London, and the development of the splendid sites on both banks of the Thames will never be carried out. It is high time to apply the closure to the debate and get on with the work.

A Report and a Conference.

Two events of outstanding importance in the science of engineering must be mentioned. The first was the appearance early in the year of the report of the Bridge Stress Committee which was appointed in 1923. The report is a long and detailed one. The principal fact that it brings out is the injurious effect of the hammer blow of locomotives when it synchronises with the natural period of the bridge structure. It will do something to encourage the better balancing of railway rolling stock and may lead to the wider use of multiple-cylinder engines. The second event was the assembly of a conference upon steam tables at the Institution of Mechanical Engineers in July. Thermodynamicians of several nations took part in this conference, the purpose of which was to find international agreement. The discussions were carried on *in camera*, and the outcome was the decision to prepare skeleton tables which would include all ascertained figures with an indication of the degree of accuracy. Those tables would be revised from time to time as more precise figures or new data became available. A few weeks ago the tables were issued and were reprinted in THE ENGINEER of December 6th, 1929. They are, of course, far from complete, but they do provide a basis upon which complete international agreement may be built up.

Labour and Industry.

We are proud to say that in the engineering trades there were no serious labour disturbances in 1929, though shipbuilding was interfered with by a prolonged joiners' strike. There were discussions throughout the year about increases in the wages of mechanics, who, by comparison with other artisans, are admittedly underpaid, but the unions recognised the difficulties under which the engineering industry as a whole is labouring and did not press claims when the impossibility of granting them was explained to them. The subject however, comes up for reconsideration in the present month.

Conclusion.

Whilst it cannot be said that the long wished for revival of industry came during the past year, there were signs of improvement, as, for example, in the export of iron and steel and of coal. The shipbuilding industry also did better, and showed that our old pre-eminence has not deserted us. But the events of the past six months have done nothing to encourage the belief that the slight upward tendency will be maintained. This is a paper without a political bias. It would welcome any Government, to whatever party it belonged, which showed the statesmanship and the ability to grapple with the problems of the day on sound principles. There is no indication that the present Government possesses the necessary qualities, and its actions give us cause to look upon the immediate future with some apprehension. The principles by which it is guided are not those which should be followed at this juncture in the affairs of the kingdom. We cannot afford to be generous, to encourage reliance upon others instead of ourselves, to give amenities and comforts to those that cannot earn them. Such things might be done when the country was blessed with surplus wealth. They are intolerable when it is struggling to meet its debts. We cannot go on living for ever on an overdraft. The essential fact to which a great statesman would devote all his energies is the recovery of trade. If that can be brought about, then the social problems—unemployment, insurance, prolonged education—will either settle themselves or will fall within the limits of prudent finance. Mr. MacDonald appears to be wholly indifferent to this fact. Every stroke of his policy is likely to hamper the progress of industries towards recovery. He has embarked upon new expenditure which will necessitate increased taxation, and has introduced a coal-mining Bill which will raise the price of that essential commodity. When he ought to have diminished the financial burdens which industries have to bear, he has augmented them, and he has added to social amenities at a moment when the country is barely able to meet its necessities. A policy of retrenchment was called for; he has embarked upon one of prodigality.

These facts naturally give rise to no little anxiety about the future. The ability of the engineering industries of the country is as great as ever; they are quite capable of attaining once more their old position; but they cannot do it in the face of competition upon neutral markets if they are hampered by ill-timed legislation. The wise physician does not overtax the growing strength of a convalescent.

Aeronautics in 1929.

ALTHOUGH the past year was marked, in this country at least, by a regrettably large civil aviation casualty list, it, nevertheless, contributed notably to the advancement of aeronautics. It witnessed, on the one hand, a decided quickening of popular interest in flying, and, on the other, it saw the completion or coming to fruition of several important technical developments.

On the spectacular side the annual Royal Air Force display at Hendon in July provided the public with the usual excellent opportunity of observing the performance of our latest types of military machines. The display was followed almost immediately by the opening of the seventh International Aero Exhibition at Olympia, at which the developments made on the constructional side since the previous Exhibition in 1920 could be inspected at close quarters. In September the contest for the Schneider seaplane trophy was held over the Solent and revealed even to the most

uninitiated something of the great developments which within recent years have been made in the construction and performance of extra high-speed aircraft. Finally, the public mind was undoubtedly impressed with the rapidly growing significance of flight as a factor in everyday life by the trial trips towards the end of the year of the British airships R 100 and R 101 over large areas of the country.

On the technical side it may justly be said that the year saw the final emergence of aircraft construction into a definite and highly specialised branch of engineering. The Exhibition at Olympia in 1920 left many people with the impression—and it was not wholly erroneous—that the methods of aircraft construction then in use were tentative, and that at many points resort had to be made to expedients of a doubtful kind. Last year's Exhibition presented an entirely different picture. Inspired by the Air Ministry's expressed desire and intention, practically every maker, it was found, had abandoned wooden for metal construction. It was not merely the replacement of one material by another. The use of aluminium alloy, high-tensile steel and stainless steel or rustless iron had, it was observed, led to radical departures in the design of details and was tending to make general developments follow a course that would scarcely have been practicable had the former extensive reliance on spruce and ash been continued.

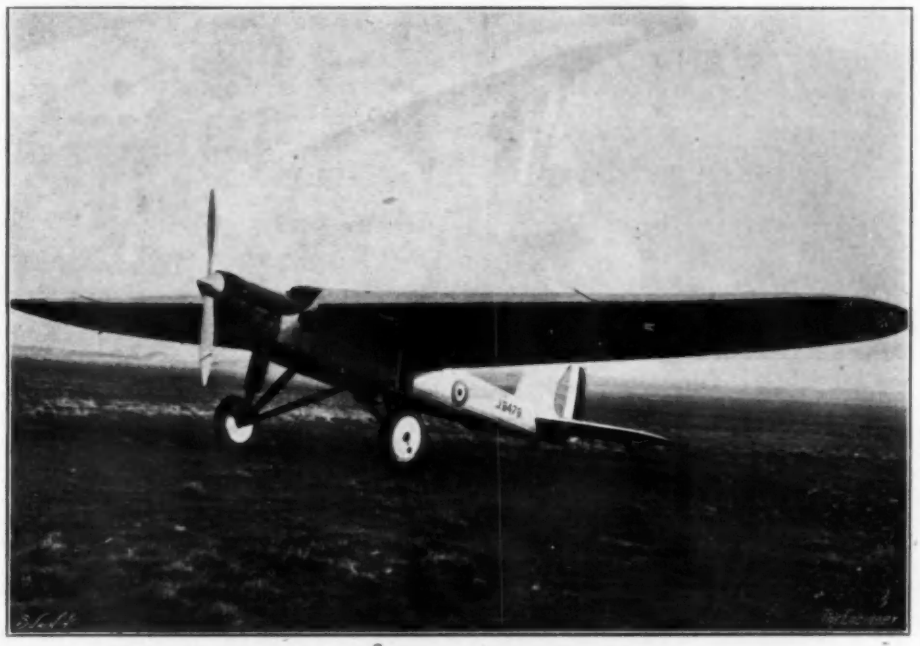
Following a disaster to a twin-engined Imperial Airways machine while crossing the English Channel in June, considerable attention was paid in public and technical circles to the safety of multi-engined aeroplanes. The Exhibition at Olympia showed that aircraft designers were well ahead of public and judicial opinion on this subject, and that for civil machines there was a wide movement to adopt the three-engined aeroplane as the standard design. One firm, the Gloster Company, showed a twin-engined machine —partially built—which, it was claimed, would be able to climb to 10,000ft. and fly level at that height in the fully loaded condition with one of its engines out of action. This machine, illustrated on page 16, has now been completed and has, we are informed, considerably exceeded its predicted performance. It was designed especially for aerial survey work, and an example will shortly be employed on such work by the Aircraft Operating Company in Rhodesia. Except, however, for military purposes and for such special duties as aerial surveying, it cannot be doubted that the twin-engined machine capable of flying level with one engine out of action is uneconomical when both engines are at work, as they are normally, for obviously each engine in normal flight will be required to develop only about half its full power. A close study of the subject strongly suggests that the most economical solution of the problem in its commercial aspects is the three-engined machine which can maintain level flight and, if necessary, climb with any one of its engines idle. Machines of this class were produced during the year by a considerable number of makers. A typical example of this type exhibited at Olympia was the six-seater Westland limousine monoplane, of which we give an illustration above.

On the military side a noteworthy event of the year was the production of several successful designs of single-seater interceptor fighter. The development of the fast day bomber with a speed and a manœuvrability little, if anything, short of the performance of a fighting scout created an urgent demand for a new type of machine to deal with it. The interceptor fighter is the solution that has been provided. This machine is required to be capable of rising from the ground and engaging a hostile aeroplane flying at, say 150 m.p.h. at a height of 15,000ft., the first sight of the enemy being obtained when it is directly over the point at which the interceptor machine is waiting to take off. This specification requires that the interceptor should combine in some optimum ratio a high rate of climb and a high speed at altitude. It is also necessary that the machine should be so designed as to give the pilot a clear upward view in order that he may not lose sight of his quarry during the ascent. The characteristics of the machine are necessarily such as to give it a high landing speed and otherwise to make it suitable for operation only in the daytime by highly skilled pilots. Several firms produced interceptor fighters during the year, such as the H. G. Hawker Company, the Fairey Aviation Company, Vickers Aviation, and the Gloster Company. The Vickers interceptor fighter exhibited at Olympia is illustrated on page 20. It is an all-metal low-wing monoplane built on the Vickers-Wibault principle, even the wing coverings being made of metal. Although this machine is a monoplane with the wings well below the cockpit, the monoplane type is not universal among interceptor fighters. For example, the Hawker, the Fairey, and the Gloster interceptors are all of the biplane type. That there is considerable diversity of opinion among designers as to the best aeronautical form to adopt in order to fulfil the requirements laid down for the interceptor fighter is, however, clear. The Westland machine of this class, illustrated on page 20, is, like the Vickers, a monoplane of the low-wing type. It is driven by a Bristol "Mercury" II.A engine, and is equipped with two enclosed guns firing forward. The height to which it may have to ascend in order to engage its enemy entails the provision of oxygen breathing apparatus for the pilot, while in order to facilitate alighting at the high landing speed unavoidable in this class of machine, brakes are fitted to the chassis wheels. The machine is of all-metal construction.

It cannot be disputed that the movement in favour of a return to the monoplane type of construction for machines of all classes gained considerable impetus during the year. It may perhaps be worth recalling that in the early days of aviation the monoplane was greatly favoured by many pioneer designers. One or two accidents to machines of monoplane construction led in this country to a discrediting of the type on the ground of lack of strength and to an almost exclusive adoption of the biplane. The outbreak of war saw this country too deeply committed to the biplane form of construction to permit a reconsideration of the claims of the monoplane. The adhesion to the biplane was no doubt sound policy, in view of the times through which the country was passing, but after the war the retention of that policy was perhaps unduly prolonged. With the coming of metal construction and the development of the deep-sectioned cantilever wing, the monoplane returned definitely to favour. It would now seem that the monoplane, at any rate for commercial purposes, is likely soon to exceed the biplane in popularity. Its development has been continuous during the past few years, and has shown a vigour which has been somewhat lacking in the development of the biplane. It is noteworthy, for instance, that both types of seaplane produced in this country for the 1929 Schneider Trophy contest, the Supermarine Rolls-Royce S 6 and the Gloster Napier 6—both of which are illustrated on page 16—were of monoplane form. So far as the Supermarine Company was concerned, the monoplane form of its machine represented a continuation of its previous successful practice in the design of high-speed seaplanes. In the case of the Gloster Company, the biplane type was traditional until 1929. The Gloster design for last year's race was originally a biplane, and showed very excellent wind tunnel test results. It was, however, found impossible to obtain a suitable and strong enough anchorage for the new Napier racing engine, because of the biplane formation. The designers were therefore forced to adopt the monoplane form.

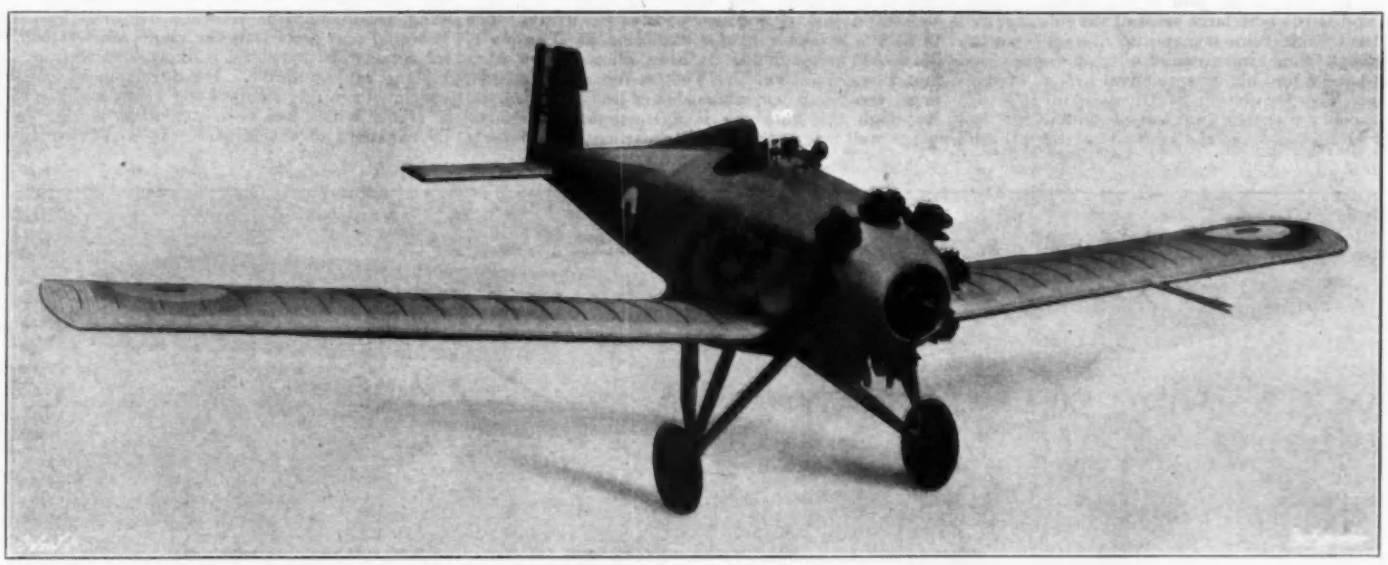
In passing it may be recorded that the Trophy was gained by the Supermarine machine with a speed of 328·6 miles an hour, and that subsequently on a straight course the same machine established a world's record speed of 357·7 m.p.h. The Gloster machine was not flown in the contest, but subsequently it flew on a straight course at 336·3 m.p.h., although the weather conditions were bad and the engine was not developing its full power. It is of interest to note that although the Gloster machine was designed for extra high speed near the ground, it also has very remarkable climbing ability. It can

WESTLAND 6-SEATER, 3-ENGINED LIMOUSINE MONOPLANE

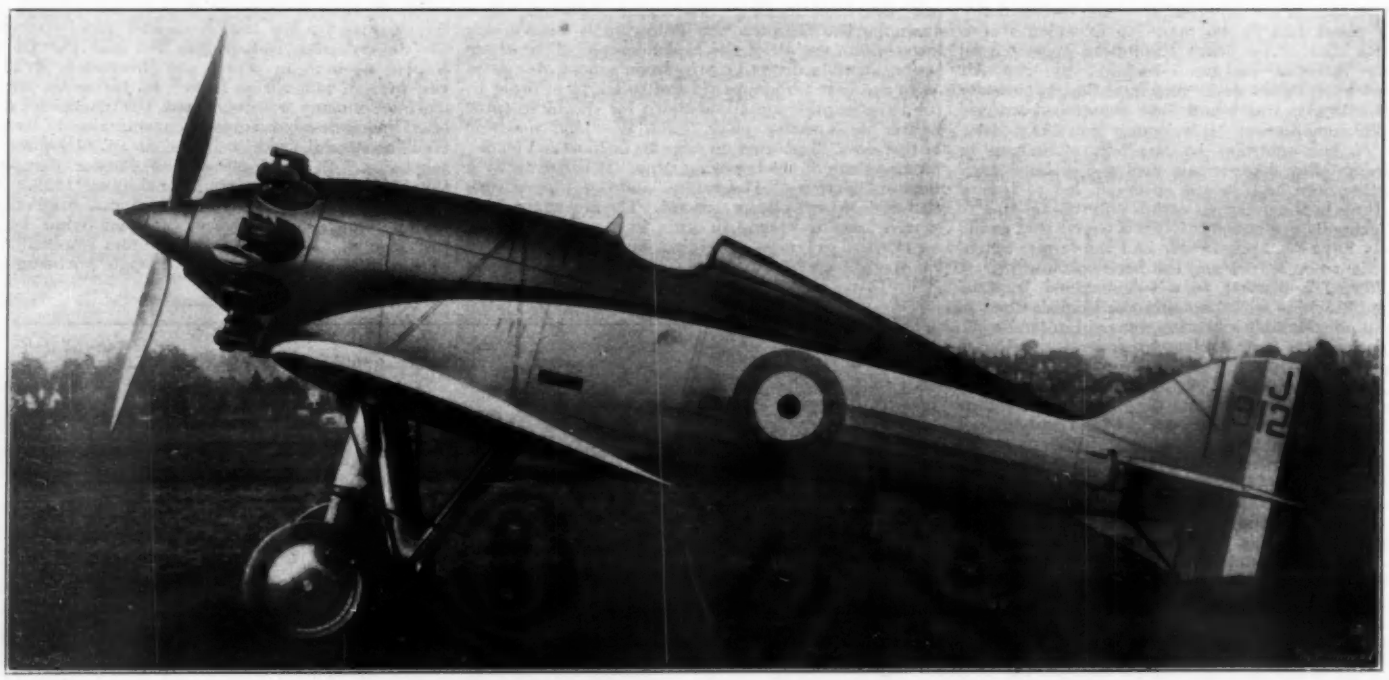


FAIREY LONG-RANGE MONOPLANE

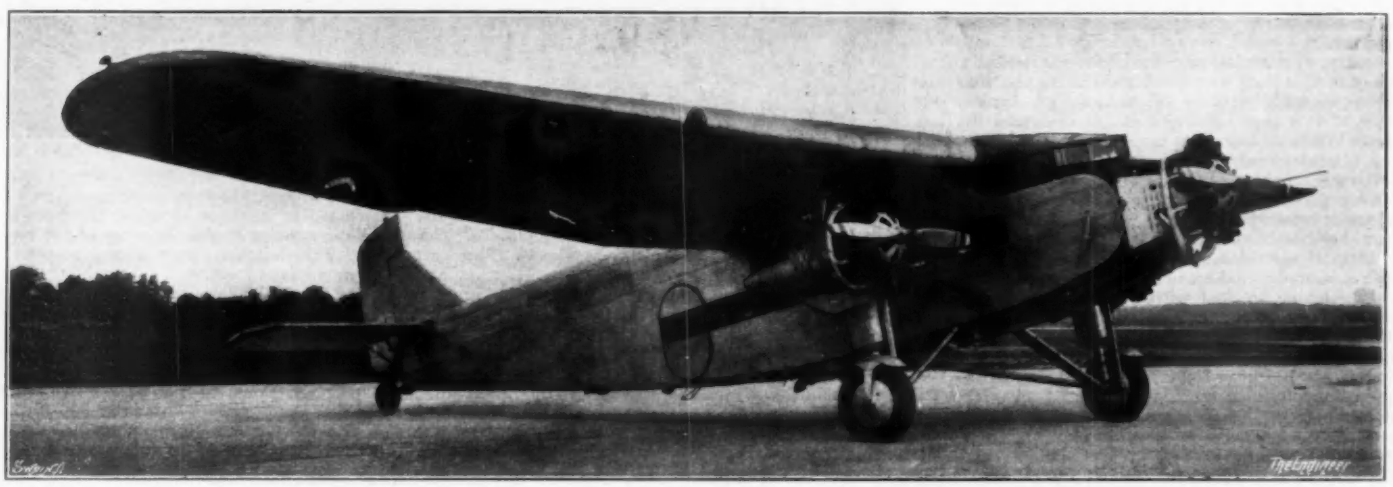
SOME AIRCRAFT OF 1929



VICKERS SINGLE-SEATER ALL-METAL INTERCEPTOR FIGHTER



WESTLAND SINGLE-SEATER ALL-METAL INTERCEPTOR FIGHTER



FORD ALL-METAL 14-PASSENGER MONOPLANE

actually rise from sea level at a vertical rate of nearly a mile a minute, a rate of climb which, it is claimed, has never before been achieved by any other machine.

It should not be thought that the monoplane type is especially in favour for high-speed machines, such as racing seaplanes and interceptor fighters. The Westland three-engined limousine, to which we have already referred, is of the monoplane type, and numerous other examples of monoplane civil passenger carrying machines were produced during the year, notably the Avro-Fokker five and ten-seater machines, the Saunders four-seater civil flying boat and the Ford 14-passenger machine—see page 20. These machines were exhibited at Olympia, and were described in our columns last July.

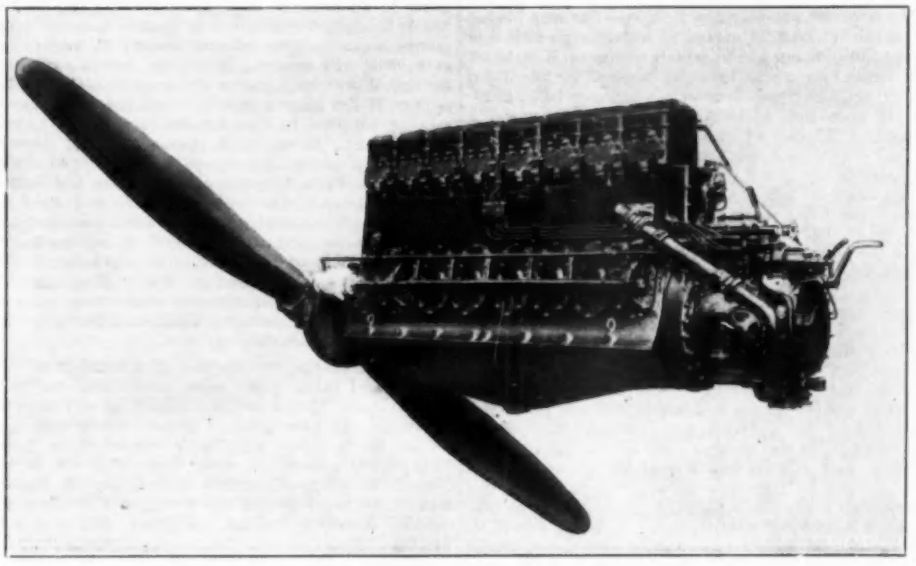
For an attempt on the world's long-distance continuous flight record a machine was produced by the Fairey Aviation Company, and here, again, we find the monoplane principle adopted. This machine, illustrated herewith, started from Cranwell on April 24th, and flew without a stop to Karachi, covering a total distance of about 4130 miles in 50¾ hours. It took off with about 3½ tons of petrol on board, and but for exceedingly unfavourable weather the flight would have been considerably greater than it was before the fuel supply became exhausted. On December 17th the same machine left Cranwell on an attempt to fly non-stop to the Cape. The attempt failed. The machine met with disaster near Tunis, and both the pilots lost their lives.

Of all the recent developments of the monoplane, none perhaps exceeds in interest the super-large monoplane machines which were completed in Germany during the year. One of these huge craft, the Dornier Do X flying boat, is illustrated on page 16. This machine is driven by twelve Jupiter engines of 500 horse-power each, arranged in six tandem pairs on top of the wings. The engines are all controlled from a central station and stand over 21ft. above the water line. The total lifting surface area of the wings is about 5000 square feet. On its first public flight the machine carried 169 people, together with fuel sufficient for a trip of 750 miles. The machine and its load on this occasion weighed 50 tons. It took off and landed with ease, and was readily handled in the air. The second huge German monoplane completed during the year was the Junkers G 38, a land plane fitted with four Junkers engines, developing a total of 2400 horse-power. Two of the engines, each of 800 horse-power, drive four-bladed tractor screws, and two, of 400 horse-power each, drive two-bladed screws. All four engines are built into the leading edge of the wings. The machine weighs 13 tons empty and 20 tons when loaded. A feature of the design is the fact that the passengers are, partly at least, accommodated inside the wing, the leading edge of which on both sides of the fuselage nose is provided with windows. This arrangement has been rendered practicable by the adoption of a wing section of great thickness. In both these huge machines the construction is entirely of metal, even to the wing coverings.

Apart from the aeroplane developments briefly indicated above, the year was of great interest aeronautically by reason of the considerable amount of airship activity which it witnessed. In this country the Government airship R 101 completed her shed trials on October 1st, and on October 12th was successfully launched and taken to the Cardington mooring tower. Following several successful voyages, during one of which she remained in the air for thirty hours, she was returned on November 30th to her shed for minor alterations and adjustments, and to make room at the tower for the airship R 100, which had been waiting at Howden for a favourable opportunity to be launched. On November 22nd R 100 was taken over by the Air Ministry for flight trials from the contractors, the Airship Guarantee Company, Ltd., and after a delay caused by unfavourable weather, the vessel was launched from her shed on December 16th. She flew for a few hours at reduced speed and then proceeded to the tower at Cardington. Following a second flight on December 18th, she was housed in the second shed at Cardington for minor adjustments to her fabric covering.

So far the airship R 100 cannot be said to have been fully tested, but in the case of R 101 the flights carried out have been sufficient to enable a very good opinion to be formed of her capabilities and characteristics. An official report on the performance of both vessels will, it is understood, be issued when all the trials have been completed. Meanwhile, as regards R 101, it may be said that she has justified the faith of her designer in his departure from the traditional Zeppelin type of hull structure, in so far that she has successfully carried out the manœuvre, turning at high speed, the attempt to perform which led to the ill-fated R 38 breaking in two in August, 1921. In one respect at least the vessel has surpassed her designer's expectations. It has been found that the control surfaces at the tail are all easily operated by hand, and that the servo-motor system which was provided as likely to be required at times, is not necessary. The servo-motor system is being, or has been, removed, with a resulting gain in disposable lift of half a ton or so. It has also been found that too generous a clearance was allowed between the gas bags and the frame structure, and that without running any risk of the bags touching the frame during flight or manœuvring, it will be possible to let out the gas bag netting to an extent that will increase the gas capacity by an amount giving an increased lift of 3 or 4 tons.

The report we have to make concerning the engines of R 101 is less satisfactory than we could have wished, but in view of the experimental nature of her power plant and the extremely valuable technical information which has been acquired by the experience of designing, installing and operating it, adverse criticism of the Ministry's decision to employ heavy oil engines of a hitherto untried type would be quite misplaced.



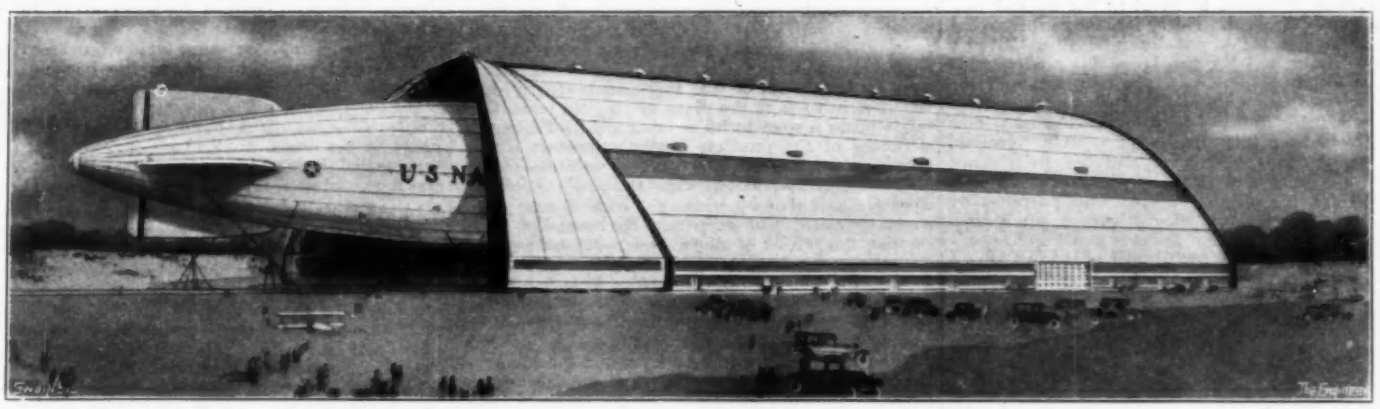
BEARDMORE "TORNADO" HEAVY OIL ENGINE FOR R 101

One of the five Beardmore "Tornado" engines with which R 101 is equipped is illustrated herewith. The engine is of the compression ignition type, using a fuel oil of high flash-point. The designed output was 650 B.H.P. at 1000 r.p.m., and on bench tests this output was satisfactorily achieved. The official test figures surpassed the guaranteed consumptions, the fuel oil required at full load being found to be only 0·393 lb. per B.H.P. per hour and the lubricating oil requirements being as low as 0·0064 pint on the same basis. The engine is, however, admittedly excessive in weight, weighing about 8 lb. per B.H.P., or 3 to 4½ times as much as existing British designs of water-cooled aero-engines using petrol as fuel. Again, as is now well known, it was found that the engine when coupled to an air screw developed torsional resonance in its crank shaft, a consequence, no doubt, of the comparatively long crank shaft which the adoption of the eight cylinders in line arrangement entails. At the Royal Aircraft Establishment, a torsiograph record showed that with the crank shaft originally fitted in the engine, there was a plus and minus variation of fifteen times the mean torque instead of the 75 per cent. variation which would be normal to the engine if there had been no resonance. The crank shafts were increased in stiffness, but even so it was not found possible to avoid the minor critical speeds.

One unfortunate consequence of this resonance in the crank shafts was that the hollow metal reversible pitch blades were found to crack under it. The idea of employing reversible blades had to be abandoned, at any rate for the time being, until improved solid duralumin blades could be developed that would withstand the resonance. The vessel has so far flown with non-reversible blades of wood. One of the engines has had to be reserved exclusively for propelling the vessel astern, by means of a screw with a reversed pitch. This fact, combined with the additional fact that the engines have to be run at 900 r.p.m. instead of at the designed speed of 1000 r.p.m., has resulted in the power available for driving the ship ahead being reduced from a total of 3250 B.H.P. to a total of 2340 B.H.P.

The advantage of using heavy oil engines in airships is so great, particularly if journeys to tropical climates are contemplated, that it is imperative if airships are to be given a fair chance of establishing their commercial utility to proceed with the development of this type of engine. We are glad to learn that Messrs. Beardmore have already such development well in hand. The engine being developed will have the same size of cylinders as the "Tornado," namely, 8½in. bore by 12in. stroke, but it will have six cylinders in line instead of eight, and will run at a considerably higher speed.

In the United States preparations were begun for the building of two airships, each with a gas capacity of 6½ million cubic feet. The gas to be used will be helium and will give each vessel a gross lift of 180 tons, as compared with the 152 tons of the 5 million cubic feet of hydrogen carried in R 101. These American



NEW AIRSHIP SHED AT AKRON, OHIO, FOR THE GOODYEAR-ZEPPELIN CORPORATION

vessels will have a length of 785ft., a maximum diameter of 134ft. 9in., and a height of 146ft. 5in. They will be driven by eight engines, developing a total of 4480 horse-power. It is of interest to note that by the use of helium instead of hydrogen in these vessels, each will have its gross lift reduced by some 20 tons.

For the time being interest in the new American airships is centred more in the shed in which they will be constructed and housed than in the vessels themselves. The vessels are to be built for the United States Navy by the Goodyear Zeppelin Corporation, of Akron, Ohio. The shed is now completed or rapidly approaching completion. We reproduce herewith a sketch representing its finished appearance. It will be capable of taking both ships simultaneously, and will have a length of 1175ft., a width of 325ft., and a height of 197ft. The total area covered by it will be 364,000 square feet. One of the most interesting features of the design of the shed is to be found in the arrangement of the end doors. At each end the shed is closed by two leaves, which together constitute a quarter of a hemisphere. The top points of the leaves are fastened to the main shed of the building by pins, 17in. in diameter. The lower edges of the leaves are supported on double-flanged wheels running on a standard gauge track, which is curved to a radius of about 187ft. The leaves will be opened and closed by means of electric motors.

Great as is the departure of the design of R 101 from traditional airship practice, it is as nothing compared with the possible revolution represented by the airship Z M C 2, built by the Aircraft Development Corporation, of Detroit, which made its first flight, lasting 49 min., on August 19th, and which was handed over a month later to the United States Navy for trial and experiment. This vessel has a helium gas capacity of 200,000 cubic feet, and is entirely of metal construction. The metal clad airship has figured in the dreams of many inventors, but it has been repeatedly proved to be impracticably heavy. The Aircraft Development Corporation was, however, not convinced of the conclusiveness of the arguments, and expended five years and £60,000 on an intensive study of the problem. In the end, it proved previous conclusions to be wrong, its proof taking the very practical shape of an airship, 149ft. in length and 53ft. in diameter, capable of lifting a useful load of 3127 lb., and flying 680 miles at a cruising speed of 50 m.p.h. The skin of the vessel consists of "Alclad" aluminium alloy sheeting, less than $^1/_{100}$th of an inch in thickness. From bow to stern the skin is composed of 142 sections, varying in width from 6in. to 18in., each in the form of a truncated cone and riveted one to another in a specially invented machine, the joints being made gas-tight by means of a bitumen compound. Five main and seven subsidiary rings stiffen the skin internally. The rings are stayed by radial wires and are united to one another by twenty-four longitudinal girders. The skin not only replaces the fabric covering of the traditional airship, but serves as the actual gas container, and, in addition, acts structurally as part of the hull. The hull was erected vertically in two parts, which, when completed, were brought together horizontally and riveted to one another. A car capable of containing a crew of three and four passengers is slung beneath the hull, and on each side of it on outriggers there is a Wright "Whirlwind" engine of 220 H.P. The control surface arrangement is almost as novel as the general construction of the vessel. Thirty feet forward from the stern there are eight equally pitched radial fins. The two upper and the two lower fins are provided with co-acting rudders, and the two port and the two starboard fins with co-acting elevators.

It is a little difficult to determine exactly how seriously to take this airship. The facts, however, that it has been constructed and has been flown successfully on several occasions, and that it has been officially taken over for experimental purposes by the United States Navy, suggest that it is not altogether ridiculous. As the vessel is small and experimental, we need not be too critical of the fact that a single hailstone might readily pierce the very thin metallic skin, and allow all the gas to leak away. Doubtlessly, in a larger vessel transverse bulkheads would be provided to isolate the gas into a number of compartments.

Some Bridges of 1929.

The Ambassador Bridge.—Several bridges were completed during the year. Among the most interesting was the Ambassador Bridge over the Detroit River, between Detroit in Michigan and Sandwich in Ontario, which was formally opened for traffic on November 11th. Ceremonies were performed on both sides of the River, the Hon. Charles McCrea, Minister of Lands and Forests for Ontario, officiating on the Canadian side, and the Hon. Frederick A. Green, Governor of Michigan, officiating on that of the United States. It had been intended that this bridge should have been opened on July 1st, which would, as a fact, have been a year in advance of its projected completion, so rapidly had it been constructed. It happened, however, that a few breakages of wires in the suspension cables, which had not been considered significant, were observed early in the year, but much more serious fractures in the cable wires of the Mount Hope Bridge were discovered about the same time. As the wires in both cases were from the same source, and as the metal of which they were made had been treated in the same way, it was decided that it would be unsafe to proceed with the completion of the Ambassador Bridge, and the drastic measure of discarding the cables was adopted. It is a matter for wonder that although this decision was only arrived at right at the end of March of last year, and that in spite of the fact that the cables, which had a span of 1850ft., were in position and carrying a considerable suspended load, it was still possible to dismount them, procure and fix new cables, and to complete the bridge seven months ahead of the original day appointed for its completion. Full particulars of how the feat was achieved have not yet reached us, but its accomplishment evoked world-wide admiration.

The Khartoum-Omdurman Bridge.—The new bridge across the White Nile, a view of which is given in one of our Supplements, and which connects Khartoum with Omdurman, was formally opened by Sir John Maffey, the Governor-General, on January 16th, 1928. Strictly speaking, therefore, it cannot be termed a bridge of 1929, but we make mention of it here as we did not have an opportunity of describing it until February of the latter year. The bridge, which, with its approaches, has a total length of 3466ft., comprises seven fixed spans, each of 240ft., and a swinging span of 304ft. The main trusses of the fixed spans are of the simple Warren type in eight panels of 30ft., and having a depth of 36ft. at the centre and 30ft. at the ends. The main girders are arranged at 30ft. centres apart. The swing span when rotating is carried at its centre on a roller path, 25ft. 4½in. in diameter and 11½in. on the face. When in the closed position and taking the load it is supported on its extreme ends by bearings on the adjacent piers of the fixed spans. These end bearings are of the usual screw wedge type, and when screwed home they reduce the deflection in the ends of each of the main trusses by 1½in., and in that way adjust the stresses in the main trusses to take the working loads which are experienced when the bridge is in the closed position. The span is operated electrically by means of a 20 H.P. motor, the time taken to move it through a right angle being about 3 minutes. The roadway across the bridge has a clear width of 28ft., and it is traversed by a single line of 3ft. 6in. electric tramway. Provision was made for the future addition of two cantilever footpaths, each 11ft. wide, on the outsides of the main girders.

Royal Albert Bridge, Saltash.—An exceedingly interesting piece of bridge work, which was completed at the beginning of the year, was the reconstruction of the land spans of the Royal Albert Bridge, which carries the main line of the Great Western Railway across the Tamar at Saltash. This bridge was designed by Isambard Kingdom Brunel, and was built between the years 1853 and 1859. With the exception of the fitting of new cross girders in 1905 and the reconstruction of two of the land spans at Saltash Station to enable the double line to be extended to the structure, the bridge, until this new work was taken in hand, had remained exactly as it was built. In 1927, however, it was decided, in view of the increased weight of modern locomotives and rolling stock, to renew the main girders of the fifteen remaining land spans. For that purpose a special form of erection wagon was designed by the railway engineers. A view of it is given in one of our Supplements. By means of this wagon two new girders, which were to take the place of two old ones, were taken on to a span to be reconstructed. The superstructure of the erection wagon comprised a continuous steel lattice girder—known as the carrying girder—of greater length than the span, and there were arrangements by which the ends of this girder could be raised and supported by means of jacks, so that the bogies of the wagon could be removed during operations. Arranged at right angles on the top members of the carrying girder were four transverse girders forming four cross members. This carrying girder served several purposes. First of all, from it was suspended by adjustable chains the whole of the permanent way of the span under reconstruction, so that the weight was taken off the original girders. Then the latter were lifted up and traversed outwards so as to be well clear of the positions which they had occupied. Then the new spans, which had been suspended from the transverse members before the erection wagon was got into position, were, in turn, traversed outwards until they came exactly over the positions which had been vacated by the original girders. They were then lowered on to seats which had been prepared for them and secured, after which the cross girders carrying the permanent way were bolted to them. The chains carrying the permanent way were then slacked off and removed, the bogies of the erection wagon were again got into position, and the erection wagon, carrying the two old girders outside the newly fixed girders, was slowly and carefully withdrawn from the span. The work of replacement, which was carried out entirely by the Company's staff, working on Sundays only, was effected precisely to schedule, forty-three Sundays being required for the operations. This work was described and illustrated in our issue of June 21st last.

Water Supply in 1929.

No. I.

Introduction.

THE year 1929 will long be remembered by many waterworks engineers as one of grave anxiety. There were, first of all, the severe frosts of the early months, which took their toll of burst water mains and pipes, besides introducing difficulties at filtration works. Then there was a drought which persisted, in some places practically without break from early in the spring until the end of September, and finally, there were the excessive rains and floods of November and December. The number of burst water mains in the metropolitan area were, to all seeming, more frequent and serious than usual, though it was officially stated that the occurrences were neither extraordinarily numerous nor extraordinarily severe. Moreover, it was announced by the Works and Stores Committee of the Metropolitan Water Board, on which falls the duty of maintaining supplies in the London area, that though, undoubtedly, severe cold might and did occasion fractures of mains, it was not the only cause of such failures, and the Committee pointed to the injuries brought about by the increased speed and weight of modern traffic as contributory factors. However, the Committee decided to appoint a sub-committee specially to consider and report on the subject. The Council of the Institution of Water Engineers also appointed a strong committee of waterworks engineers to investigate the matter. That committee has not yet completed its inquiries.

Throughout the country the total number of burst service and other pipes must have been enormous. Approximate figures for two places, at any rate, are available. In Liverpool, it is said, there were some 29,000 burst pipes, and, as a consequence, nearly 130,000,000 gallons of water were lost. It is estimated that the total number of burst pipes in Burnley was 19,500 and that the loss occasioned by damage to meters, lavatory fittings, cylinders, &c., was some £40,000.

In some parts of the country the drought in the early part of the year was more pronounced than in others. Yorkshire began to suffer early. For the five months from February to June inclusive the precipitation was only just over 3·0in., which is, of course, far below the average. Before the end of June, Barnsley, Batley, Bradford, Dewsbury, Doncaster, Halifax, Huddersfield, Leeds—to name just a few—had begun to feel the effects, some of them severely. Bradford's supplies, it was reported, had not been so low since the early 'eighties. Halifax had more than 425,000,000 gallons less in its reservoirs than at the same time the year before. At Hull the water level in the wells from which its supplies are drawn was some 20ft. below normal. Leeds had only 106 days' supply in store, as compared with 150 days in 1928 and 165 in 1927. Reports for other parts of the country showed the position to be quite as bad, if not worse. The East Cheshire authorities, for example, gave notice that if the drought did not break they would have to shut off supplies. In Edinburgh in the beginning of July the position was described as being "very serious." In many villages in Essex water had to be carted some distance and was sold at so much a bucket. At a village in Buckinghamshire as much as twopence a gallon was being given a little later in the year. Similar instances might be adduced almost indefinitely. There is no doubt that much inconvenience was experienced throughout the land, and that over a wide area a great deal of hardship had to be undergone.

In the metropolitan area, though there was never any real shortage—thanks to the large volumes in the reservoirs, which were heavily drawn upon—restrictions prohibiting the use of water for garden watering through hoses and the cleaning of motor cars had to be imposed. It is probable, however, that that measure would not have been resorted to had consumers as a whole "played the game"—if we may be permitted to use such a colloquialism—when asked to be careful of the water, instead of—as they did—using an average of 30,000,000 gallons—or approximately 4 gallons a head—more per day than before the request was promulgated.

Another trouble, attributable to hot weather, was the excessive algal growths in reservoirs which was experienced in many places.

Then came the rain; and when it did come it came down in no uncertain fashion. In many cases all anxiety regarding supplies was almost immediately at an end, though in others difficulties were encountered, and strange as it may seem, there are as we write—nearly at the end of December—still places which are suffering from a shortage of water which, in some cases, is very severe. Whether or not the later rains will make good the depletion arising from two successive dry seasons—for it will be remembered that the year's precipitation 1928 was also deficient over wide areas—remains to be seen. Springs and wells were several years recovering their normal flows and levels after the abnormally dry summer of 1921, and it is to be feared that those places which rely on such

sources for their supplies may still have hard times in front of them.

Metropolitan Water Board.

We have received from Mr. Henry E. Stilgoe, M. Inst. C.E., the Chief Engineer of the Metropolitan Water Board, the following particulars which he has courteously prepared specially for us, regarding the works completed by the Board during the year 1929:

Works in Connection with the Supply from Queen Mary Reservoir at Littleton.—The construction of the twenty-four open rapid gravity primary filters at Kempton Park was completed, and they, in conjunction with the new Pumping Station at Kempton, were put into service by the Minister of Health on October 24th last. We deal with this station in a separate paragraph. The laying of mains to supply raw water to the primary filters for conducting the primary water to the secondary filters and for taking the increased discharge of the secondary filters to the pumps, and also of various delivery mains from the new pumps to the existing pumping mains, was completed early in the year. The contractors who carried out the construction of the filters and the laying of the mains were William Moss and Sons, Ltd. In order to provide intercommunication between the districts supplied from the Board's pumping stations at Kempton Park and Hampton, a contract was let in July last to Whittaker Ellis, Ltd., for the laying of a 42in. main from Kempton to Hampton, a distance of about 2½ miles. This main is to be connected with the delivery mains from the Kempton Park Station which supply portions of the Northern and Western Districts, and with the various mains from the Hampton Station supplying the Western and Southern Districts. This link will enable either of the above stations to assist the other in the event of a breakdown to a pumping engine or main.

Works for the Improvement of the Supply North of the Thames.—The construction of the concrete-covered service reservoir of a capacity of just over 20 million gallons at Bishops Wood, in the parish of Hornsey, was completed with the exception of the internal rendering, the earth covering to the roof and the soiling and sowing of the roof and embankments. The walls and floor of the reservoir are constructed in mass concrete, and the roof in reinforced concrete supported on the mass concrete walls and reinforced concrete columns. The depth of water is to be 20ft. The work is being carried out by Messrs. Stewart and Partners, of Baker-street, W. In May last the oil engine driven centrifugal pumps for the supply to Darnicle Hill Reservoir, Cheshunt, were set to work. Messrs. W. and C. French, of Buckhurst Hill, Essex, recently completed the laying of a 20in. diameter main from the Board's pumping station at Haggar-lane, Woodford, to Buckhurst Hill Reservoir, for the improvement of the supply to the north-eastern portion of the Board's Northern District. A contract was entered into with the Lilleshall Company, Ltd., for the provision and installation of three Davey-Paxman oil engine driven reciprocating pumps at Haggar-lane, Woodford, to replace old and uneconomical steam engines, and to provide for an increased supply to the area served by this station. The tender of Messrs. F. R. Hipperson and Son was also recently accepted for the necessary alterations to the buildings to accommodate the new machinery.

Works in Connection with the Supply to the Board's Southern, Western, and Kent Districts.—The work of remodelling and combining the old Lambeth and Chelsea Stations at Surbiton has been commenced. Tenders were invited for the supply of the main portion of the new pumping plant, consisting of four steam turbine driven centrifugal pumping units, of a total pump horse-power of 4906. Tenders will also be invited shortly for the alteration to the buildings which are to house the new machinery. A contract was let to John Mowlem and Co., Ltd., of London, in the early part of the year for the laying of 24in. and 18in. mains connecting with the existing 42in. and new 48in. mains from Cricklewood to Fortis Green to improve the supply to Hendon. This work was completed before the end of the year. Tenders were invited in the early part of the year for the construction of a new pumping station at Deptford. The successful tenderers were William Moss and Sons, Ltd., of London and Loughborough, and the building, particulars of which were given in our last Annual Article, is now approaching completion. In November a contract was entered into with Messrs. John Thompson for the supply and erection of four water-tube boilers for providing steam for the new machinery now completed at the works of Hathorn, Davey and Co., Ltd., and Belliss and Morcom, Ltd., ready for erection. The sinking of the new well, which is 14ft. in diameter, was completed during the year, and work is now proceeding on the three adits to connect this well with the existing wells. During the year two sets of Ruston and Hornsby oil engine driven Mirrlees-Watson centrifugal pumps were installed in an existing building altered for the purpose at the Board's pumping station at Honor Oak. Each engine is capable of delivering 3 million gallons per day against a head of 200ft., or 6 million gallons per day against a head of 100ft. These pumps are to be used to augment the supplies to the areas supplied from Bickley and Bromley Reservoirs and to Beckenham and Penge in times of great demand. Two 24in. mains were laid, one from Honor Oak pumping station to Nunhead Reservoir, connecting also with the mains supplying Beckenham and Penge, and the other from Forest Hill to Bromley-road, Catford, connecting at Forest Hill with an existing 20in. main from Honor Oak to Forest Hill Reservoir, and at Bromley-road with the distribution mains in the Bromley and Bickley reservoir supply system. In connection with the sale of land by the Board to the London Power Company at the Board's Depôt, Battersea, it became necessary to construct a new suction tank for the steam-driven turbine which supplies intercommunication water from the district south of the Thames to the Northern and Western Districts. This suction tank is constructed with mass concrete walls and floors and reinforced concrete roof, supported on the walls and reinforced concrete columns. A large overflow pipe from this tank discharges into the River Thames, in the bed of which it was necessary to lay a concrete spillway.

New Filtration Plant at Kempton Park.

The extensions to the Kempton Park Pumping Station of the Metropolitan Water Board, which were carried out to the designs and under the supervision of Mr. Henry E. Stilgoe, M. Inst. C.E., the Board's Chief Engineer, were, as stated above, formally opened by the Minister of Health. The station at Kempton Park as originally constructed comprised two storage reservoirs, together capable of containing 300 million gallons; twelve slow sand filters, each with an area of three-quarters of an acre; and a pumping station containing five pumping units, two of them designed to raise 15 million gallons per day against a head of 32ft., and three designed to deliver 8 million gallons a day each of filtered water against a head of 170ft. The extensions included the addition of primary filters through which the water coming down the Littleton Conduit or the Staines Aqueduct is passed before being led to the slow sand filters, and the installation of a pair of magnificent new pumping engines, each of some 1000 H.P., in order to deal with the additional volume of treated water which has thus been made available. The plant has so recently been described in our columns—see the issue of THE ENGINEER for October 25th last—that it will not be necessary here to deal with it in any detail. It will suffice to say that the rapid filters, of which there are twenty-four, are contained in a specially designed building adjacent to the slow sand beds. Each filter measures 26ft. by 16ft. in plan and is designed to deal with from 100 to 200 gallons per square foot per hour. The arrangements for cleansing the filtering material are excellently designed and carried out. The discharge from the slow sand filters can be chlorinated before being distributed. Ordinarily the rapid filters are fed by gravity from the Littleton Reservoir, but there are arrangements by which they can be supplied by pumping from that source, should the head fall below a certain level, or from the Staines Aqueduct. The new pumping units are housed in a new building alongside the existing pumping station. They are operated by compound steam engines with cylinders 29in., 54in. and 86in. diameter respectively and a stroke of 5ft. 6in. Each cylinder drives a compound ram having effective diameters of 25½in. and 30½in., which can be altered at will. The steam pressure is 200 lb. per square inch. The new plant is designed to pump (*a*) 24 million gallons per day against a head of 400ft.; or (*b*) 32 million gallons a day against a head of 300ft., or 38 million gallons per day against a head of 200ft. These pumping engines are, so we understand, more powerful than any other steam pumping engines of this type in operation in Europe at the present time.

Batley.

The Brownhill Reservoir, situated at an elevation of about 720ft. above sea level upon the river Holme, above Holmfirth, in the West Riding of Yorkshire, which has been under construction by the Batley Corporation during the last four or five years, was practically completed, having been recently filled with water to the satisfaction of all concerned. The dam, which is of earthwork, is about 110ft. in height, and impounds between 250,000,000 and 300,000,000 gallons of water. The additional storage capacity, thus created, is almost equivalent, in volume, to that of all the other reservoirs made previously, and will result in a gain to the borough of more than 1,000,000 gallons per day. The valley of the river Holme, as a site for reservoirs, is one which, in years gone by, has been a fruitful source of difficulty in connection with waterworks enterprise, but accumulated experience and the adoption of modern methods, have enabled everything encountered to be overcome with conspicuous success on the present occasion. The engineers are Messrs. G. H. Hill and Sons, of Manchester, while R. Lehane, Mackenzie and Shand, Ltd., of Derby, were the contractors.

(To be continued.)

THE plaintiff in an action against the London and North-Eastern Railway Company sought an Order to compel the Ministry of Transport to produce the statutory return of an accident sent in by the railway company. Mr. Justice Finlay, in Chambers, held that the return was privileged and that the plaintiff was not entitled to its inspection. The appeal against that decision was dismissed in the Court of Appeal on December 19th.

The World Engineering Congress in Japan.

(By Our Special Representative.)

No. V.*

TOKIO, November 20th.

Chinese authors are responsible for a few papers, among them, one on "The Development of the Metallurgy of Antimony" (Chung Yu-wang), which surveys the practice past and present of smelting in China; another on a subject of well-nigh universal interest, "The Value of Chinese Architecture" (Hoa Nan-kuai E.S.T.P. de Paris), which unfortunately is disposed of in less than a thousand words—a subject so rich treated with undeserved brevity.

Sir Henry P. Maybury gives some statistics of road development in Great Britain, revealing the enormous expenditure modern traffic conditions have made necessary in that small island. According to the figures published in Sir Henry's paper, between 1914 and 1926 the gross expenditure on roads increased from 18 to 59 millions sterling, and the number of licensed motor vehicles from 322,000 to 1,698,000; the population during this period increasing from 40,055,000 to 43,964,000. (There was an actual decrease in population during the war years 1914–17.) The future development of England will partake less and less of the haphazard character of the past, as a direct consequence of the opening of the furthest recesses of the country by motor traffic, providing increased scope of usefulness to the architect, and his modern associate, the town planner. "Recent Developments in Town Planning" (Alfred T. Pike) is the only paper on this new subject, which was given legal authority by the Town Planning Act of 1909, improved by subsequent Acts, and consolidated by the Town Planning Act of 1925, to quote Mr. Pike. By this measure, local authorities in England with a population of over 20,000 on January 1st, 1923, must prepare a scheme by January 1st, 1934, which must make provision for new roads, widening of old roads, limit the heights of buildings and adjoining spaces, and restrict the number of houses to be erected per acre. In each community will be residential, industrial, and commercial areas, and sites reserved for recreative purposes. At last the English are to attempt to become systematic, and it is to be hoped the natural genius of the nation will not suffer thereby. Standardisation and rationalisation may go too far.

"The British Light Car" (A. H. Wilde) and "The Motor Cycle Industry in Great Britain" (Major H. R. Watling) are two papers of interest in relation to Sir Henry Maybury's paper. Mr. Wilde gives full specifications of the smallest and the largest vehicles respectively in the light car class. Similar cars are now being turned out by the hundred by the Ford and General Motors assembly plants in Japan, where there is a steadily increasing market for cars and trucks, and these concerns would benefit by a little wholesome rivalry.

Major Watling shows that Britain has developed a most prosperous industry in the motor cycle, and enumerates its extraordinary equipment, compared to what it was in the early war days; moreover, with all its improvements, rated at a 250 per cent. increase in efficiency, to-day's model costs less than that in 1914.

Still of interest in relation to Sir Henry Maybury's paper is that on "Modern English Architecture" (Howard Robertson, F.R.I.B.A.), who deals briefly with conditions on the Continent and in England, and in passing refers to what is actually in some countries in danger of passing—the true architectural design—with the development of the steel frame and the elimination of all style and ornament. Something like Chicago poetry, Mr. Robertson says: "A great improvement in the method of training architects, and the establishment of numerous schools of architecture throughout the country, is resulting in a high standard of composition and the understanding of structural principles. The sound and tasteful tradition of English architecture is to-day being developed in an interesting modern way, but the architectural development in big cities is still much hindered by the work of the so-called 'commercial architect,' who is not architecturally qualified."

What appears to the writer to be the most abstruse paper in all the seven hundred is that entitled "The Calculation of the Articulation of a Telephone Circuit from the Circuit Constants" (John Collard, B.Sc., A.C.G.I., A.M.I.E.E.), which, apparently, is a new science developed by the telephone, on which subject there are three additional papers by members of the National Telephone and Telegraph Corporation's Development and Research Laboratories, respectively French, American, British. The telephone in its practical application is one of first-rate interest to every business man in Japan, where the price of the telephone placed in your house or office is Yen 1200, say, £120 sterling. This price is fixed by Government. The telephone situation here is so outrageous that foreign newcomers refuse to believe it, and quite naturally imagine that the old stagers are engaged in some regulation joke. The matter as it affects

* No. IV. appeared December 27th, 1929.

foreigners assumed a serious aspect quite recently when the Japan agent of a firm in Europe sent to headquarters a statement of establishment expenditure, which included the item Yen 2000 for telephone. He was threatened with legal proceedings, and it took quite a lot of explaining. In the boom years, 1917–21, the price of a telephone rose as high as Yen 4000. This extraordinary situation is created by that condition that causes all high prices—scarcity of the article in demand. It could be remedied within a year, but the interest of the "telephone broker," behind whom are banks who finance the broker, is of greater concern to the Government than the interest of the public. When some years ago, it appeared that an effort was to be made to end the situation and provide telephones for all who required them, the brokers rose in protest at the threat to their "interests," and had their way.

There are several ways of obtaining a telephone. One may be rented at a charge of from Yen 20 to Yen 30 per month, according to number and the condition of the market. It is installed at a charge of about Yen 25—payable by renter—who must also pay the quarterly Government fee for use, amounting to Yen 16·50, and the sum of 3 sen per call. To those in a hurry there is what is called "quick installation," whereby one who has deposited Yen 15 with the official telephone bureau and been promised an instrument within seven years, may obtain installation within six months by payment down of Yen 500 or thereabouts. Hundreds of thousands of ratepayers are on the books of the telephone bureaux in the different towns of the empire, each having paid a deposit of Yen 15—on which he receives no interest—who are patiently waiting, waiting. It has been said that a people has the Government it deserves!

Another new science. This is the science of foundations ("Settlement Analysis") set forth in an interesting way in a paper by Professor Charles Terzaghi, of the Massachusetts Institute of Technology, who compares the old methods of ascertaining the character of foundations—a haphazard procedure, mere guesswork largely—with the new practice, an elaborate process of examination of soils and strata. The author concludes his survey with these observations: "In the field of foundation engineering the organised efforts are of very recent origin and confined to European countries. In the writer's opinion, the success of these efforts will largely depend on the degree to which the investigators succeed in freeing themselves of conceptions borrowed from the field of structural engineering and on the energy and insight with which they engage in the task of settlement analysis. If they recognise the full importance of settlement analysis and act accordingly, their activities will soon disclose to the profession the absurdity of the principles of present practice, and they will educate the younger generation of foundation engineers to think in terms not of codified values but of physical processes. On the other hand, if the investigators fail to check their theories and conceptions against the results of extensive actual observations, their efforts are doomed to sterility and the public will continue to pay the price of the ignorance of its professional advisers."

A tribute is paid to one of the leading scientists of Japan by Mr. Herbert M. Boylston, Professor of Metallurgy in the Case School of Applied Science (U.S.), whose contribution to the literature of the Congress is entitled "Fifty Years of Physical Metallurgy," and contains the following reference to the increase of research work in Japan:—"As early as 1915, the Temporary Research Institute for Physical and Chemical Investigation of the Tohoku Imperial University was founded with Dr. Kotaro Honda as its chief investigator. This gradually grew in size until, in 1919, it was announced by Imperial Ordinance No. 229 that the Research Institute of Iron and Steel was attached to the Tohoku Imperial University, having two resident professors, five assistant professors, and five assistants with Dr. K. Honda as Director. Many important reports were issued by this institute, both on ferrous and non-ferrous subjects. In 1926, there were seven professors, ten assistant professors, six lecturers, seven associates, eighteen assistants and three clerks, in addition to some twenty-seven machinists and eighteen other persons for research and office work. Up to October, 1925, over one hundred and forty-four papers had been published, and these were eagerly read by metallurgists all over the world."

A survey of the extraordinary development and diversity of the chemical industry in the United States, stimulated immensely by the war, is contained in a paper by Arthur D. Little. The chemical industry, Mr. Little points out, is highly favoured in being free of labour troubles, perhaps because of the fact that the development of machinery has disposed to a large extent of the need for labour, which is illustrated in the following excerpt from his paper:—"In several of the most widely installed processes for cracking petroleum for gasoline, no more than two men are required for the operation of a plant having a daily throughput of 500 barrels of oil."

(To be continued.)

A PAPER pulp mill is to be erected at Chatham, New Brunswick, by the International Paper Company.

Motor Ships and Marine Oil Engines in 1929.

No. I.

IN the year which has just ended marked progress was again recorded in the construction of motor ships and marine oil engines, and British shipbuilders and marine engineers maintained with ease the leading position in the world for motor ship construction which they have now held for so many years. After an unchanged output of about forty ships, representing close upon a quarter of a mill on gross tons in the years 1924 to 1927, the 1928 output rose to seventy-three ships of 468,477 gross tons total, and an aggregate indicated horse-power of 305,960. Last year, however, there was a slight falling off in the number of ships actually completed and handed over, which was explained partly by the long-continued strike of shipyard joiners at Belfast and partly by the comparatively late placing of some of the orders. It is satisfactory, however, to note that the gross tonnage, in spite of the eighteen fewer ships completed, was nearly maintained, while the total indicated horse-power of propelling machinery was actually increased. Such an increase is a clear indication of the higher-powered engines which are now being installed in both passenger and cargo ships.

In Table I. on the page opposite we give the returns for each year, as recorded in our columns over a period of ten years, and in Fig. 1 these are reproduced for the first time in a graphical form. In accordance with our custom in previous years, we have detailed in Table II. full particulars of all the motor ships over 1000 tons gross which were built and engined in Great Britain and Northern Ireland during 1929. These particulars have been compiled from figures supplied at our request by builders and owners, and we have only included vessels which, as far as we are aware, have already run their acceptance trials.

There is every prospect that the present year will prove even more successful than the past, from the

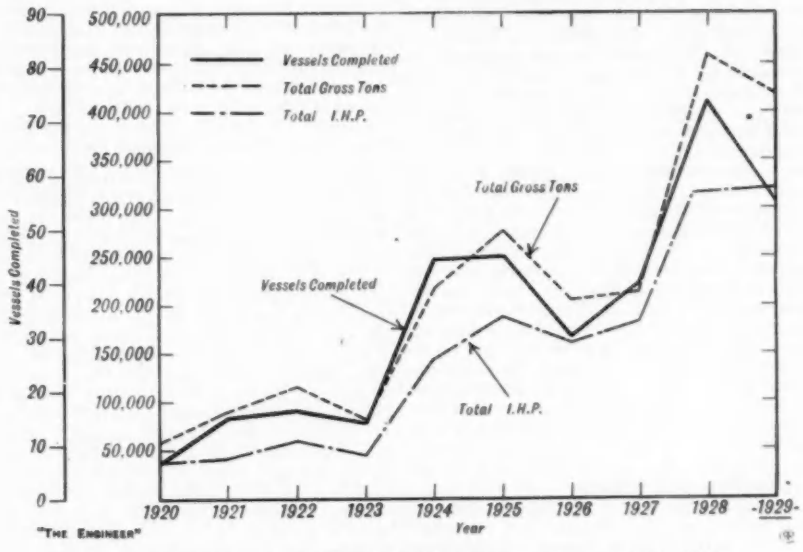


FIG. 1—MOTOR SHIP AND MARINE OIL ENGINE OUTPUTS 1920—1929

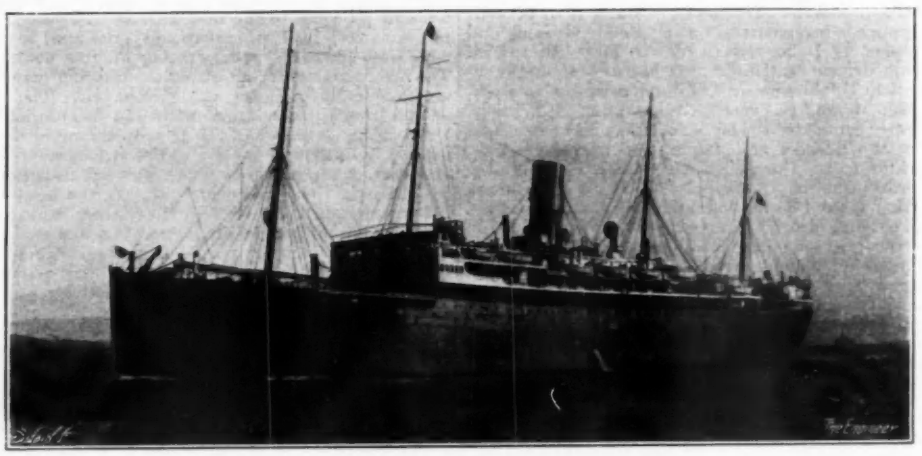


FIG. 2—THE BIBBY MOTOR LINER "STAFFORDSHIRE"

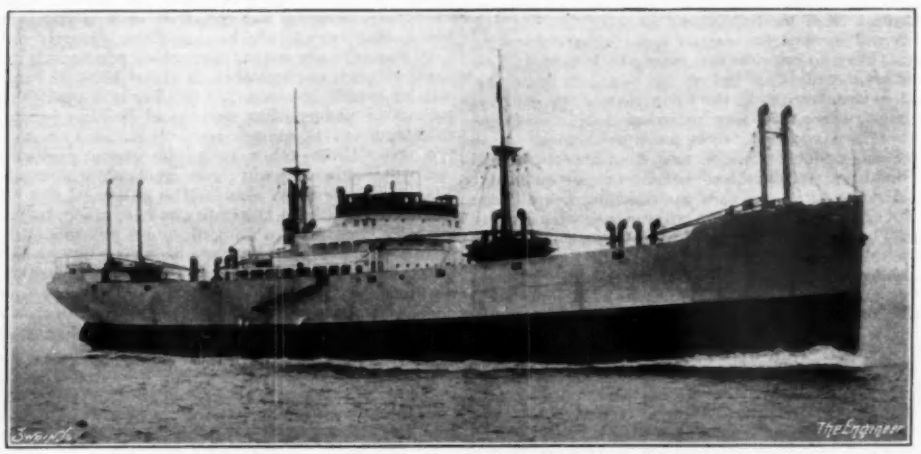


FIG. 3—THE MOTOR CARGO LINER "VILLANGER"

BRITISH-BUILT MOTOR SHIPS AND MARINE OIL ENGINES, 1929

TABLE I.—*Motor Ships of 1000 Gross Tons and Upwards Fitted with Marine Oil Engines and Completed in Great Britain and Ireland During the Years 1920 and 1929 Inclusive.*

Year	1920.	1921.	1922.	1923.	1924.	1925.	1926.	1927.	1928.	1929.
Number of ships completed	7	15	17	14	43	44	30	40	73	55
Total gross tons	53,407	83,980	114,527	78,862	231,764	282,325	212,063	228,751	468,477	422,424
Total I.H.P.	31,140	42,860	69,820	49,137	145,130	180,125	160,460	174,905	305,960	336,290

TABLE II.—*British-built Motor Ships and Marine Oil Engines*, 1929.

Owners.	Name of ship.	Speed and type	Shipbuilder.	Hull particulars.				Type of propelling machinery.	Main engine particulars.					Number of and kW size of auxiliary generator sets
				Length B.P.	Breadth m'lded.	Depth m'lded.	Gross tonnage		Cyl. bore.	Piston stroke.	R.p.m.	Total I.H.P.	Total S.H.P.	
				Feet.	Feet.	Feet.			mm. & in.	mm. & in.				
Adelaide Shipping Co., Ltd.	Manunda	15½-knot pass. & cargo	William Beardmore and Co., Ltd.	430	60	29·5	9,000	Two 8-cyl., 4-stroke, S.A., Harland-B. & W.	740	1,500	125	11,000	8,000	5, 220 kW
Argentine Navigation Co., Ltd.	Cardiff	10-knot cargo	A. and J. Inglis, Ltd.	275	42	13	1,500	Two 6-cyl., 4-stroke, S.A., trunk-piston, Harland-B. & W.	400	750	155	1,200	900	Electric aux.
	Glasgow	,,	,, ,, ,,											
Australind Steam Shipping Co., Ltd.	Australind	10-knot cargo	William Denny and Bros., Ltd.	410	54	29·75	5,020	One 6-cyl., 2-stroke, S.A., Denny-Sulzer	600	1,060	100	2,400	1,800	Steam aux.
	Armadale	,,	,, ,, ,,											
Bibby Line, Ltd.	Staffordshire	15-knot pass. & cargo	Fairfield Shipbuilding and Engineering Co., Ltd.	482	60	36·25	10,500	Two 8-cyl., 2-stroke, S.A., Fairfield-Sulzer	28	39	110	9,600	7,700	3, 110 kW
British Oil Shipping Co., Ltd.	Oil Reliance	10½-knot tanker	Swan, Hunter and Wigham Richardson, Ltd.	410	53·25	31	5,665	One 7-cyl., 2-stroke, S.A., Swan-Hunter-Polar	600	1,200	100	3,500	2,500	1, 15 kW and steam
Court Line, Ltd.	Aldington Court	10-knot cargo	Wm. Pickersgill and Sons, Ltd.	405·5	55·5	25·1	4,891	One 3-cyl., 2-stroke, opposed-piston Doxford	580	2,320 total	83	2,150	1,850	2, 15 kW and steam aux.
	Bonnington Court	,,	Robert Duncan and Co., Ltd.	405·5	55·5	25·1	4,909	One 6-cyl., 4-stroke, S.A., Kincaid-Harland	740	1,500	[illegible]	[illegible],670	2,050	2, 15 kW and steam aux.
	Cressington Court	,,	Northumberland Shipbuilding Co., Ltd.	405·5	55·5	25·1	5,000	One 3-cyl., 2-stroke, opposed-piston Doxford	580	2,320 total		2,150	1,850	2, 15 kW and steam aux.
Entre Rios Railways, Ltd.	Carmen-Avellaneda	11¼-knot train ferry	A. and J. Inglis, Ltd.	355·5	57·5	19·7	2,235	Two 8-cyl., 4-stroke, S.A., trunk type, Harland-B. & W.	15¾ 400	29½ 750	155	1,850	1,400	2, 55 kW
Holland-America Line	Delftdijk	14-knot cargo	Wilton's Engineering and Slipway Co.	490	64·5	40	10,220	Two 8-cyl., 4-stroke, S.A., Harland-B. & W.	740	1,850	96	8,600	6,500	4, 150 kW
Alfred Holt and Co., Ltd.	Agamemnon	Pass. & cargo	Workman, Clarke (1928) and Co., Ltd.	453·6	59	35·25	7,900	Two 8-cyl., 4-stroke, S.A., pressure-charged, B. & W.	740	1,500	110	10,500 Pres.	8,600 charg'd	3, 170 kW
	Menestheus	,,	Caledon Shipbuilding and Engineering Co., Ltd.											
Hopemount Shipping Co., Ltd.	Hopemount	11-knot tanker	Swan, Hunter and Wigham Richardson, Ltd.	450	60·75	33·25	7,434	Two 6-cyl., 2-stroke, S.A., Wallsend-Sulzer	31	43	93	3,900	2,800	2, 10 kW
Huddart Parker, Ltd.	Westralia	15½-knot pass. & cargo	Harland and Wolff, Ltd.	430	60	33·5	8,108	Two 8-cyl., 4-stroke, S.A., Harland-B. & W.	740	1,500	115	8,800	6,600	3, 200 kW
Imperial Oil Co., Ltd.	Calgarolite	12-knot tanker	Furness Shipbuilding Co., Ltd.	522	70·5	38·75	11,941	Two 6-cyl., 2-stroke, S.A., Krupp	680	1,300	90	6,600	5,000	2, 105 kW, 1, 45 kW
Iranian Tanker Co., Ltd.	Irania	10-knot tanker	Blythswood Shipbuilding Co., Ltd.	275·5	44	20	2,186	One 3-cyl., 2-stroke, D.A., Richardsons-Westgarth	630	1,300	120	1,400	1,250	2, 50 kW & steam aux.
Lyle Shipping Co., Ltd.	Cape Horn	tanker	Lithgows, Ltd.	425	56	30	5,643	Two 8-cyl., 4-stroke, S.A., Kincaid-Harland	740	1,500	110	4,220	3,600	3, 100 kW
Lancashire Shipping Co., Ltd.	Penrith Castle	13¼-knot cargo	Cammell Laird and Co., Ltd.	460	60	31·5	7,000	Two 6-cyl., 4-stroke, S.A., North-Eastern-Werkspoor	730	1,500	110	6,000	4,500	3, 100 kW, 1, 65 kW
	Thurland Castle	,,	,, ,, ,,											
Nelson Lines, Ltd.	Highland Brigade	16½-knot pass. & cargo	Harland and Wolff, Ltd.	523·4	69·4	35·75	14,131	Two 8-cyl., 4-stroke, D.A., Harland-B. & W.	680	1,600	95	13,000	10,000	4, 200 kW
	Highland Chieftain	,,	,, ,, ,,											
New Zealand Shipping Co., Ltd.	Rangitiki	15-knot pass. & cargo	John Brown and Co., Ltd.	530	70	43·3	16,750	Two 5-cyl., 2-stroke, S.A., Brown-Sulzer	900	1,600	88	12,400	9,300	2, 500 kW 2, 150 kW
	Rangitane	,,	,, ,, ,,											
	Rangitata	,,	,, ,, ,,											
Moss Line, Ltd.	Kufra	Cargo	Harland and Wolff, Ltd.	350	47	30·4	2,600	One 8-cyl., 4-stroke, S.A., Kincaid-Harland	630	1,300	110	3,800	2,850	Electric and steam aux.
H. E. Moss and Co., Ltd.	Luculus	Tanker	Palmer's Shipbuilding and Iron Co., Ltd.	430·5	56·6	32·9	6,546	One 6-cyl., 2-stroke, S.A., Wallsend-Sulzer	680	1,200	100	3,600	2,700	Electric and steam aux.
Molasses and General Transport Co., Ltd.	Laurelwood	12-knot tanker	Sir W. G. Armstrong, Whitworth and Co., Ltd.	435	59	34	7,347	Two 6-cyl., 4-stroke, S.A., Kincaid-Harland	630	1,300	120	4,100	3,500	Electric and steam aux.
Prince Line, Ltd.	Cingalese Prince	14½-knot pass. & cargo	Blythswood Shipbuilding Co., Ltd.	442	60	32·3	6,625	Two 4-cyl., 2-stroke, opposed-piston Richardsons-Doxf'rd	600	1,800 total	115	6,500	5,350	3, 135 kW
	Siamese Prince	,,	,, ,, ,,											
	Northern Prince	16½-knot pass. & cargo	Lithgows, Ltd.	496·25	65·6	41	10,917	Two 8-cyl., 4-stroke, D.A., Kincaid-Harland	680	1,400	120	12,900	10,000	3, 350 kW
	Southern Prince	,,	,, ,, ,,											
	Eastern Prince	,,	Napier and Miller, Ltd.	496·35	65·6	41	10,926	Two 8-cyl., 4-stroke, D.A., Kincaid-Harland	680	1,400	120	12,900	10,000	3, 350 kW
	Western Prince	,,	,, ,, ,,											
Reardon Smith Line	Fresno City	12-knot cargo	Wm. Doxford and Co., Ltd.	415	55	28·3	4,955	One 4-cyl., 2-stroke, opposed-piston Doxford	600	2,320 total	92	3,270	2,900	3, 80 kW
	Vancouver City	,,	,, ,, ,,											
Rederi Aktiebolages Tanker, Ltd.	Anglo-Swede	11¼-knot tanker	Sir W. G. Armstrong, Whitworth and Co., Ltd.	460	59·6	35·6	7,969	One 7-cyl., 2-stroke, S.A., Atlas-Polar	670	1,260	100	4,100	3,050	Steam aux.
Skjelbreds Rederi A.G.	Egeroe	11-knot tanker	Swan, Hunter and Wigham Richardson, Ltd.	465	60·75	33·25	7,590	One 6-cyl., 2-stroke, S.A., Wallsend-Sulzer	31	43	93	3,900	3,100	2, 10 kW and steam
Silver Line, Ltd.	Silverpalm	14-knot cargo	J. L. Thomson and Sons, Ltd.	450	61·3	26·9	5,955	Two 4-cyl., 2-stroke, opposed-piston, Richardsons-Doxford	600	1,800	112	6,800	5,500	4, 100 kW
Sydhav Shipping Co.	Sydhav	11-knot tanker	Swan, Hunter and Wigham Richardson, Ltd.	465	60·75	33·25	7,507	One 3-cyl., 2-stroke, opposed-piston	31	43	93	3,900	3,100	2, 10 kW and steam
Sheaf Shipping Co., Ltd.	Sheafholme	11-knot cargo	Wm. Pickersgill and Sons, Ltd.	406	54	4·7	4,811	One 3-cyl., 2-stroke, opposed-piston Doxford	560	2,160 total	85	1,790	1,520	Electric and steam aux.
Tonsberg Tanker Co.	Solsten	10-knot tanker	Barclay, Curle and Co., Ltd.	400	52·5	30·5	5,379	One 3-cyl., 2-stroke, opposed-piston, Barclay-Curle	580	2,320 total	84	2,400	2,000	Electric and steam aux.
Ulster Imperial Line	Ulster Monarch	14½-knot pass.	Harland and Wolff, Ltd.	345	46	19	3,760	Two 10-cyl., 4-stroke, S.A., trunk, airless injection, Harland-B. & W.	680	980	160	7,000	6,000	3, 110 kW
	Ulster Queen	,,	,, ,, ,,											
Union Castle Line	Llangibby Castle	14½-knot pass.	Harland and Wolff, Ltd.	485	66	33·5	12,160	Two 8-cyl., 4-stroke, S.A., pressure-charged, Harland-B. & W.	740	1,500	108	9,900	8,500	3, 250 kW
United Molasses Co., Ltd.	Athelcrown	11-knot tanker	Furness Shipbuilding Co., Ltd.	528	68·5	39	12,000	Two 8-cyl., 4-stroke, S.A., Kincaid-Harland	630	1,300	115	5,670	4,250	Steam aux.
	Athel Duke	,,	R. Duncan and Co., Ltd.	475	63	35	8,882	Two 6-cyl., 4-stroke, S.A., Kincaid-Harland	630	1,300	110	3,800	2,900	Steam aux.
	Athel Viscount	,,	,, ,, ,,											
	Athel Duchess	,,	Wm. Hamilton and Co., Ltd.	475	63	35	8,882	Two 6-cyl., 4-stroke, S.A., Kincaid-Harland	630	1,300	110	3,800	2,900	Steam aux.
	Athel Sultan	,,	,, ,, ,,											
	Athel Princess	,,	,, ,, ,,											
Westfal-Larsen and Co.	Brimhanger	12½-knot cargo	Sir W. G. Armstrong, Whitworth and Co., Ltd.	395	54·7	28·75	4,900	Two 6-cyl., 4-stroke, S.A., trunk type, Kincaid-Harland	590	1,100	160	4,000	3,000	1, 100 kW 2, 65 kW
	Hindanger	,,	,, ,, ,,											
	Villanger	,,	,, ,, ,,											

point of view of motor ship construction. The orders placed with British yards include well over one hundred ships, aggregating some three quarters of a million gross tons, or about one-third of the motor ships under construction throughout the world.

Interesting technical events of the year included the successful trials of the first double-acting two-stroke marine engine of all-British design, and the construction of engines of larger cylinder power for all systems of operation. Very satisfactory progress was made in the induction pressure charging of engines, by means of exhaust gas turbine-driven blowers, the recovery of the waste heat in the exhaust gases, and the development of the principle of the airless injection of the fuel. Some new designs of reciprocating and rotary scavenge blowers were put into service with satisfactory results. From the particulars given in Table II. it will be seen that further progress was made in the standardisation of both hulls and propelling machinery.

Large and Intermediate Motor Passenger Liners.

All the British-built motor passenger liners of large size continued to operate with satisfaction to both owners and builders, and new construction was undertaken. Towards the end of the year it was announced that the White Star Line had decided to suspend work on the new 60,000-ton Atlantic motor liner "Oceanic" and to give priority to the 27,000-ton liner "Britannic," which was launched at Belfast on August 6th. Progress on this 680ft. ship, which will be the largest British motor vessel afloat, is well advanced, and in Fig 7, page 28, we show one of her two 10,000 S.H.P. propelling units, which are the largest unsupercharged engines of the double-acting, four-stroke type yet built. Towards the end of the year there was launched from Harland and Wolff's Belfast yard the first of two 20,000-ton passenger liners, the "Winchester Castle," which will be added to the fleet of the Union-Castle Mail Steamship Company, Ltd., operating from this country to South Africa. In to-day's Supplement we show one of the new intermediate class of 10,000-ton Union-Castle liners, the "Llangibby Castle," which left London on December 5th for Africa. She is a 485 ft. ship of 60ft. beam, replete with modern equipment, and with her two "motor ship" funnels and her high forward structure, she presents a handsome appearance. A sister ship, the "Dunbar Castle," was launched at the end of October from Harland and Wolff's Govan shipyard. Both ships are propelled by single-acting, four-stroke, twin-screw oil engines, which are pressure-charged on the Büchi system. During the year two further 14,100-ton, 520ft. motor passenger liners with large refrigerated cargo spaces for meat carrying were completed by Harland and Wolff, Ltd., for the service of Nelson Lines, Ltd., between London and South America, *vid* Spain and Portugal. The vessels comp'eted include the "Highland Chieftain" and "Highland Brigade," which are sister ships to the "Highland Monarch," a vessel which has given singularly good results in actual service. Two further ships for the Nelson Line fleet were launched, the "Highland Hope" and "Highland Princess," and will be finished early this year. Another liner of about 9100 tons, also engined by Harland and Wolff with four-stroke, single-acting, supercharged machinery, is the Adelaide Steam Ship Company's "Manunda," a view of which is given in Fig. 4. She is of up-to-date design and equipped with electrical auxiliaries.

A noteworthy building programme completed in 1929 was that of the Prince Line, Ltd., which added four 10,900-ton, 496ft., 16½-knot passenger and cargo liners to its fleet in order to provide a new fortnightly service between New York and Brazil and Buenos Aires. All these vessels were Clyde-built and engined, and in the Supplement we show a view of the "Southern Prince," one of the two ships built at Lithgows, Ltd., Port-Glasgow. The firm of Napier and Miller, Ltd., of Old Kilpatrick, also completed two sister vessels, the "Eastern Prince" and "Western Prince," and all were fitted with twin-screw Kincaid-Harland double-acting, four-stroke engines of over 10,000 S.H.P. A feature of these fast passenger and cargo ships is the very complete electrical equipment which includes three 350-kW oil-electric generator sets. The same owners also took delivery of two 6600-ton motor ships, the "Siamese Prince" and the "Cingalese Prince," which were built by the Blythswood Shipbuilding Company, Ltd., and engined by Richardsons Westgarth & Co. Ltd., with Doxford opposed-piston engines. The last-named ship will be employed in the service of the Rio Cape Line, Ltd.

The 17,500-ton quadruple-screw motor liner "Aorangi," which was completed by Fairfield in 1925 and is propelled with Fairfield-Sulzer, single-acting, two stroke machinery, again achieved remarkable results, and was ahead of schedule time on all her trips. A further 10,600-ton passenger and cargo liner, the "Staffordshire"—see the accompanying engraving, Fig. 2—was built and engined at the Govan yard of the Fairfield Shipbuilding and Engineering Company, Ltd., for the Bibby Steamship Company, Ltd. She is furnished with twin-screw Fairfield-Sulzer engines of 7700 B.H.P. output, and she is one more successful Bibby Line motor ship.

At Clydebank, John Brown and Co., Ltd., completed three very fine ships for the New Zealand Shipping Company, Ltd. They are the "Rangitiki," "Rangitata," and "Rangitane," and they are propelled by two sets of single-acting, two-stroke, Brown-Sulzer engines, each of which has five cylinders with a bore of 900 mm. and a stroke of 1600 mm. As far as we are aware, these are the largest cylinders, not only of the Sulzer type, but of any other type of marine oil engine afloat. On trial these vessels developed a total of 10,600 S.H.P. at 94 revolutions per minute, but their service rating is 9300 S.H.P. at 88 r.p.m. A special feature of the design, which is illustrated in the lower view reproduced on page 27, is a direct-driven, double-acting, scavenge pump and a single-crank, three-stage air compressor, which will be seen at the forward end of the engine. The illustration also shows a special silencing device, which was designed by the builders for the scavenge pump intake, and which, we are informed, gave most successful results in service. Most of the auxiliary machinery is electrically operated, and there are two 500-kW, six-cylinder, Brown-Sulzer units and two 150-kW, Weir-Sulzer units, besides Cochran type steam boilers. The view of the "Rangitata" reproduced in to-day's Supplement was taken on the Clyde shortly before the ship sailed for New Zealand. It shows the very pleasing and harmonious lines of the New Zealand ships, which make them outstanding among motor vessels completed in 1929.

Fast Cargo Ships for Colonial and other Services.

Among the motor cargo ships finished last year were two Denny-built vessels for Australian service, namely, the "Australind" and "Armadale," both propelled by Denny-Sulzer motors. Harland and Wolff, Ltd., completed the "Westralia" for Huddart Parker, Ltd., of Melbourne, which is a 15½-knot passenger and cargo liner, embodying the latest features in cabin construction and decoration. These three ships, together with the "Manunda," are an indication of the increasing interest which is being taken in motor ship operation by Australian firms. We have already referred to important motor ships built for New Zealand.

Other cargo and passenger vessels of note include two further additions to the fleet of the Lancashire Shipping Company, Ltd., operated by James Chambers and Co., Ltd., of Liverpool. We refer to the "Penrith Castle" and the "Thurland Castle." A view of the latter ship appears in our Supplement to-day. They are 460ft. vessels built on the Isherwood construction system of framing, and equipped with special cargo-handling gear and insulated holds. The main engines, which are shown in the upper view on page 27, incorporate the latest features in the North-Eastern-Werkspoor design, and they each have a total output of 2250 S.H.P. at 110 r.p.m. The view we give shows the easy access to the lower end of the cylinders and the piston-rods, which is obtained from the intermediate platform, and also illustrates the fuel pumps and starting and manœuvring controls.

Among the other ships mentioned in Table II. we may single out the Holt Blue Funnel liners "Agamemnon" and "Menestheus," which are excellent examples of "Rateau" pressure-charged, single-acting, four-stroke practice. These ships embody several improvements which have been fitted in recent Blue Funnel Line vessels, and include the almost entire use of high elastic limit steel for the hull structure and Perlit iron castings for the engines. The engines for these particular ships were supplied by Burmeister and Wain, Ltd., but the ships were built and the machinery fitted in British yards. It is worthy of note that by supercharging a total output of 8600 S.H.P., or 10,500 I.H.P., is obtained at a normal engine speed of 110 r.p.m.

A new motor cargo ship fleet, established in 1929, is that of the Court Line, Ltd., to which three 10-knot ships were added. They were built on the North-East Coast and the Clyde, and in them Doxford opposed-piston and Kincaid-Harland propelling machinery are installed. William Doxford and Co., Ltd., built and engined the first two cargo ships for the Reardon Smith Line, and Doxford opposed-piston engines were also installed in two ships, one for the Silver Line, Ltd., and one for the Sheaf Shipping Company, Ltd.

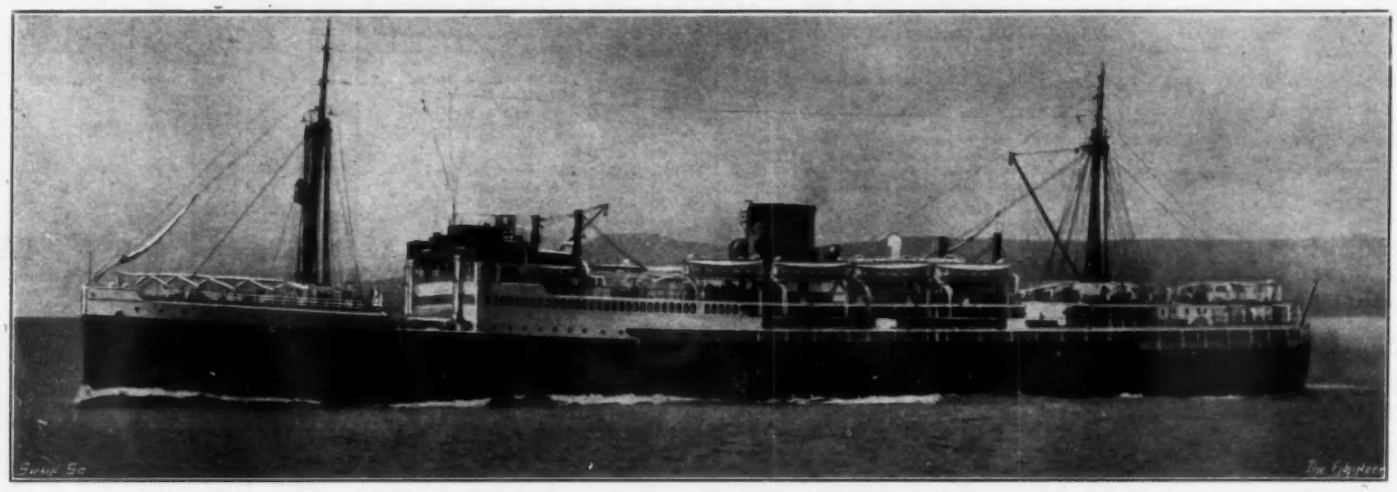


FIG. 4—THE ADELAIDE SHIPPING COMPANY'S MOTOR PASSENGER LINER "MANUNDA"

In the illustration—Fig. 3 reproduced on page 24—we show the "Villanger," one of three 12½-knot motor cargo ships, built for Westfal-Larsen and Co., by Sir W. G. Armstrong, Whitworth and Co., Ltd., and engined by Kincaid. These ships follow the Scandinavian practice of dispensing with the usual large funnel. Particulars of them are given in Table II.

A special type of motor ship, the "Carmen Avellaneda," was built by A. and J. Inglis, Ltd., and engined by Harland and Wolff, Ltd., for the service of the Entre Rios Railways. She is a 355ft., 2200-ton train ferry, with a designed speed of 11½ knots, and is propelled by twin-screw, eight-cylinder, Harland-B. & W. oil engines of the trunk piston type. Particulars of this vessel are given in Table II. She is a sister ferry boat to the "Delfina Mitre," completed by the same builders last year.

Cross-Channel Motor Ships.

An event of the year was the commissioning of the first British-owned and built cross-channel motor ship "Ulster Monarch," one of three motor vessels constructed by Harland and Wolff, Ltd., to the order of the Ulster Imperial Line. A full description of this ship will be found in our issue of May 3rd. The second ship, the "Ulster Queen," also ran her official trials, but was not finally completed, owing to the strike of shipyard joiners. She and the third ship, the "Ulster Prince," will enter the Belfast–Liverpool service of her owners early this year. A reconstructed berthing dock has been provided at Liverpool for these fine ships, which, alike in their passenger conveniences and their propelling machinery, mark an important development. By employing 6000 S.H.P., twin-screw, ten-cylinder engines of the trunk-piston type, operating with airless injection on the four-stroke, single-acting principle, it has been possible to install in a 345ft. hull of 45ft. beam and 15ft. depth, engines designed for a sea speed of 18 to 19 knots, and a maximum speed of 21 knots. In the

SOME MARINE OIL ENGINES OF 1929

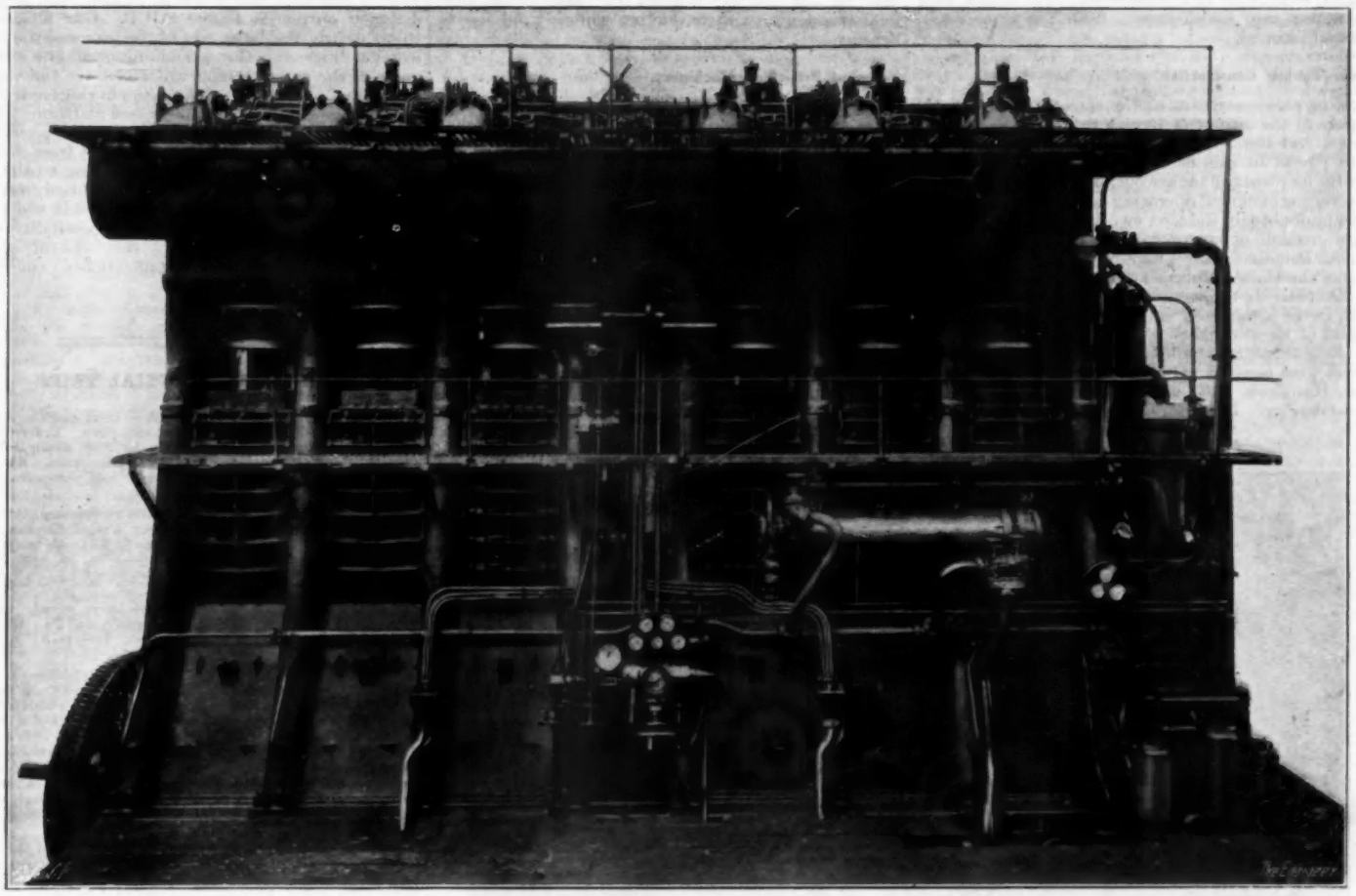


FIG. 5—2250 S.H.P. SIX-CYLINDER NORTH-EASTERN-WERKSPOOR ENGINE

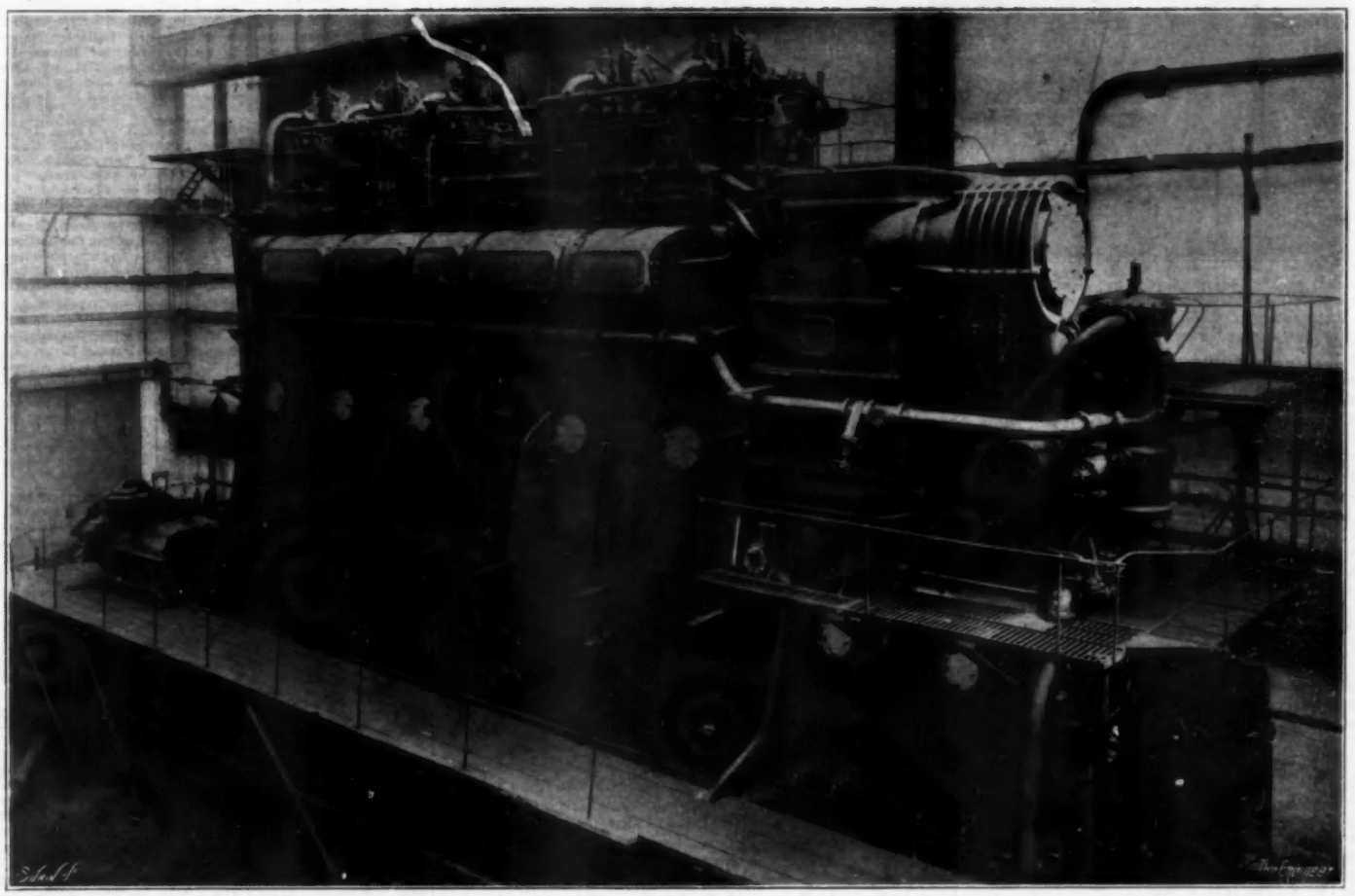


FIG. 6—9300 S.H.P. FIVE-CYLINDER BROWN-SULZER ENGINE

course of the year another North Sea cross-channel vessel, the "Esbjerg," was put into service between Harwich and Esbjerg, and in this ship, which was built and engined in Denmark, similar machinery to that installed in the Ulster Line ships is employed. There is no doubt that the successful experience gained with these new vessels will open a new field for motor ship development, both for British and colonial services.

Motor Tanker Construction.

As in previous years motor tankers again figured largely in the output of British shipyards and engine works, and towards the end of the year new orders were placed in this country and abroad which will greatly increase the tanker output of the present year. The very economical operating costs of motor tankers have undoubtedly induced owners to lay down motor ships instead of steam-driven vessels. One of the largest British tanker programmes of the year was that of the United Molasses Company, Ltd., for which no less than six tankers, ranging from 12,000 to 8800 tons, were completed and others launched. The largest of these tankers is the "Athelcrown," built by the Furness Shipbuilding Company, Ltd., and the others were constructed on the Clyde at the yards of Wm. Hamilton, Ltd., and Robert Duncan, Ltd., at Port-Glasgow. In all these ships, twin-screw, single-acting oil engines of the Kincaid-Harland type were installed. The Furness Shipbuilding Company, Ltd., completed a large 11,900-ton tanker, the "Calgarolite," for the Imperial Oil Company, Ltd., of Canada, which was engined by Krupps, while Swan, Hunter and Wigham Richardson, Ltd., completed several oil-carrying motor ships of between 7000 and 8000 gross tons, for Norwegian owners, as did also the allied firm of Barclay, Curle and Co., Ltd., of Glasgow. In most of these ships opposed-piston oil engines of the Doxford type were fitted. Sir W. G. Armstrong, Whitworth and Co., Ltd., and Palmers Shipbuilding and Iron Company, Ltd., built motor-propelled fuel oil and molasses tank ships for British and Swedish owners.

One of the most interesting motor tanker orders of the year was that placed with Scott's Shipbuilding and Engineering Company, Ltd., by the Atlantic Refining Company, of Philadelphia, for two large Diesel electrically propelled oil tankers, in which Carels-Ingersoll-Rand engines and British Thomson-Houston generators and motors, generally similar to those employed on the "Brunswick," will be installed. We understand from Mr. Lester M. Goldsmith, the owners' consulting engineer, that the performance of the "Brunswick" has been most satisfactory and economical, the results as regards fuel consumption being lower than those obtained with any other form of drive with which the owners have so far had experience. The engines and motors have run smoothly at sea over long periods, with practically no attention for repairs and replacements; while the special fitting supplied by Carels, which ensures that the fuel pump cannot come into operation until sufficient lubricating oil pressure is maintained throughout the oil system, has eliminated any trouble with bearings, which otherwise might have been caused had the engines been started up after long stoppages, without having sufficient oil in the bearings.

Types of Propelling Machinery.

Four-stroke "B. & W." Type Engines.—Reference to the particulars given in Table II. will show that the larger majority of the engines installed in motor vessels built in 1929 were again of the four-stroke, B. & W. type, operating on either the single-acting or double-acting principle, with either air or airless fuel injection. At Harland and Wolff's Belfast and Glasgow engine shops no less than 171,730 I.H.P. of machinery was constructed, which, if we except one or two sets of turbines and marine steam engines, was practically all accounted for by marine oil engines. At the works of John G. Kincaid, Ltd., of Greenock a record output of over 100,000 I.H.P., respresenting thirty-five sets of machinery of the single-acting or double-acting four-stroke type, was achieved. The first Kincaid-Harland marine oil engine was, it will be recalled, built in 1923, and it is of interest to learn that up to the end of December a total of seventy-seven sets of oil engines were built at the firm's Greenock works. At the Belfast and Glasgow establishments of Harland and Wolff, Ltd., the year's output of marine oil engines aggregated about forty, representing something over 150,000 I.H.P., corresponding to over 140,000 gross tons of motor shipping, which is a record figure. The single-acting, four-stroke engines equipped with pressure charging include those of the "Manunda" and the Union-Castle liners, the first of which, the "Llangibby Castle," left London for Africa in December. Her engine particulars are given in Table II. The engines operate with air injection and the air compressor is driven from the extended crank shaft at the forward end of the set. The air for pressure induction is supplied by exhaust gas blower of the Brown-Boveri type which deliver the air under pressure directly into the inlet manifold. The total output is thereby increased by from 35 to 40 per cent., and on some tests made in the builder's shops with the turbo-blowers attached to the engines of a sister vessel, an overall mechanical efficiency of 76 per cent. was obtained. Another feature of the installation is the use of Clarkson thimble-tube exhaust gas boilers, which supply steam for the ship's service and also silence the exhausts.

A noteworthy installation completed during the year was that for the new White Star liner "Britannic," which was launched on August 6th and is now being fitted out. A description of the ship and her engines will be found in THE ENGINEER for August 9th, 1929. She will be the largest British motor passenger liner afloat, and her engines have the distinction of being two of the highest power unsupercharged marine oil engines yet constructed. A view of the starboard set on trial at Belfast is reproduced in Fig. 7. Each engine has ten cylinders, each with a bore of 840 mm. and a stroke of 1500 mm. and the designed output is 10,000 S.H.P. Our illustration shows clearly the large size of the unit and the excellent facilities for the examination of the various parts of the engine which are given by the various platforms. The starting and manœuvring controls are at mid-engine position on the bottom platform. These engines will also work with Clarkson waste-heat boilers, which are designed to generate from 2500 lb. to 4000 lb. of steam per hour, according to the load on the propelling engines. We have briefly referred to the airless injection engines installed in the Ulster Line vessels, and there seems every possibility of an early further development of this system of fuel injection and its successful application to engines of larger outputs.

(To be continued.)

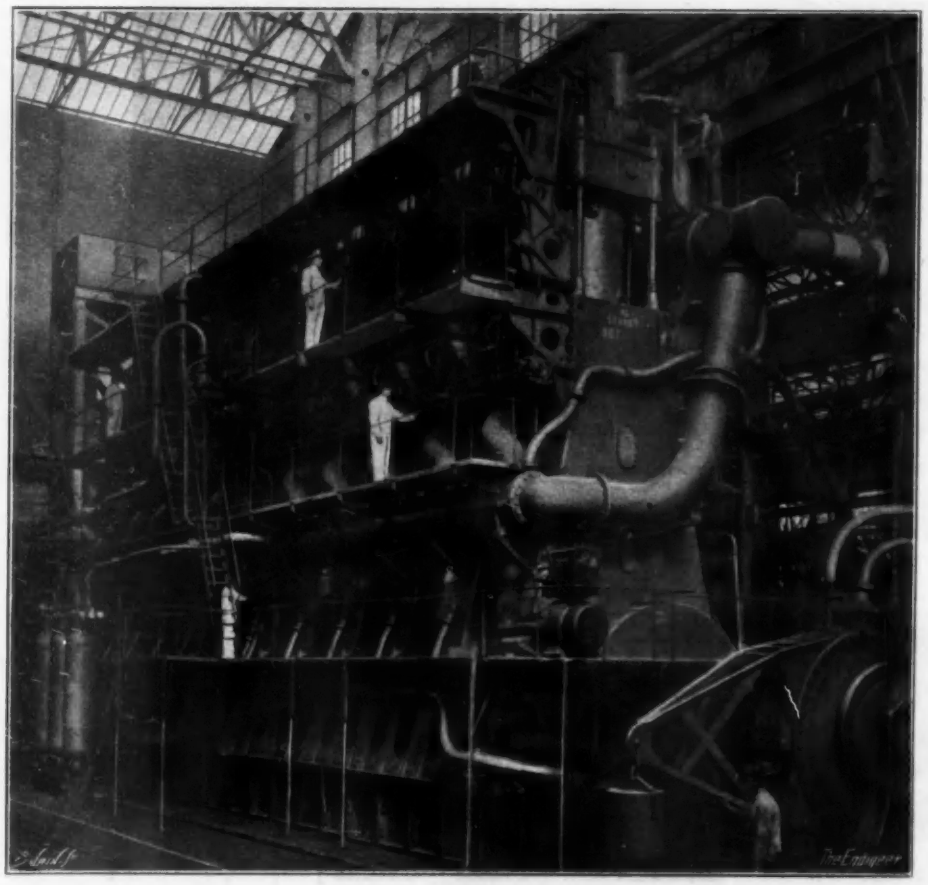


FIG. 7—10,000 S.H.P. HARLAND-B. & W. FOUR-STROKE DOUBLE-ACTING ENGINE

LAUNCHES AND TRIAL TRIPS.

GLENDENE, steamship; built by Wm. Gray and Co., Ltd., to the order of Glendene Shipping Company, Ltd., Cardiff; dimensions, 400ft. 3in. by 52ft. 6in. by 27ft. 2½in.; to carry cargo. Engines, triple-expansion, 24½in., 40in., 65in. by 42in. stroke, pressure 180 lb. per square inch; constructed by the builders; trial trip, November 21st.

JANETA, single-screw steamer; built by Barclay, Curle and Co., Ltd., to the order of the Glasgow United Shipping Company; dimensions, 402ft. by 54ft. 9in. by 31ft.; to carry cargo. Engines, triple-expansion, 24in., 40in., 67in. by 51in. stroke, pressure 200 lb. per square inch; constructed by the builders; trial trip, November 22nd.

LUCULUS, steel screw oil tank Diesel-driven vessel; built by Palmer's Shipbuilding and Iron Company, Ltd., to the order of Lucigen Steamship Company, Ltd., Liverpool; to carry oil in bulk; trial trip, November 28th.

LUXOR, motor vessel; built by Palmer's Shipbuilding and Iron Company, Ltd., to the order of H. E. Moss and Co.'s Tankers, Ltd.; to carry oil in bulk. Engines, Diesels; constructed by Wallsend Slipway and Engineering Company, Ltd.; launch, November 29th.

SIDI-BEL-ABBES, steel twin-screw steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Société Générale de Transports Maritimes à Vapeur; dimensions, 383ft. by 50ft.; to carry mails and passengers. Engines, two sets of single-reduction geared turbines of the Parsons' type: trial trip, November 29th.

KOTA PINANG, motor vessel; built by Netherland Shipbuilding Company, to the order of Messrs. N. V. Rotterdamsche Lloyd; dimensions, 464ft. 6in. by 60ft. 6in. by 33ft. 6in.; to carry 9500 tons. Engines, Fyenoord-M.A.N. motor of 5200 B.H.P.; launch, November 23rd.

TRENTBANK, steamship; built by Workman, Clark (1928), Ltd., to the order of the Bank Line; dimensions, 420ft. by 56ft. 6in. by 36ft. 3in.; to carry cargo. Engines, quadruple-expansion, 22in., 32in., 46½in. and 68in. by 48in. stroke, pressure 260 lb. per square inch; constructed by the builders; trial trip, November 27th.

SELJE, steamship; built by Palmer's Shipbuilding and Iron Company, Ltd., to the order of A/S Rederiet Odfjell, of Bergen; to carry 12,000 tons cargo. Engines, triple-expansion; constructed by the builders; launch, December 2nd.

DUDLEY ROSE, steel screw steamer; built by D. and W. Henderson and Co., Ltd., to the order of Messrs. Richard Hughes and Co.; dimensions, 250ft. by 37ft. by 18ft. 6in. Engines, triple-expansion, 19in., 31in. and 52in. by 36in. stroke, pressure 180 lb. per square inch; constructed by the builders; launch, December 4th.

GLOFIELD, steel screw steamer; built by Craig, Taylor and Co., Ltd., to the order of Humphries (Cardiff), Ltd.; dimensions, 414ft. by 53ft. 6in. by 35ft. 6in.; to carry cargo. Engines, triple-expansion, 25½in., 42in., 70in. by 48in. stroke, pressure 180 lb. per square inch; constructed by Blair and Co., Ltd.; a speed of 12 knots was attained on trial trip, December 4th.

KNIGHT OF MALTA, steamship; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of the Casser Company, Ltd., Malta; dimensions, 270ft. by 37ft.; to carry passengers and cargo. Engines, triple-expansion; constructed by the builders; a speed of 15½ knots was attained on trial trip, December 11th.

CARMEN AVELLANEDA, twin-screw motor-driven train ferry; built by A. and J. Inglis, Ltd., to the order of the Entre Rios Railways Company, Ltd.; dimensions, 355ft. 6in. by 57ft. 6in. by 19ft. 9in.; to carry trains across the Parana River. Engines, oil engines of the Harland-B. and W. type; constructed by Harland and Wolff, Ltd., Glasgow; trial trip, December 12th.

MARKLAND, twin-screw steamer; built by Earle's Shipbuilding and Engineering Company, Ltd., to the order of Mersey Shipping Company, Ltd., of Liverpool, Nova Scotia; dimensions, 338ft. by 53ft. by 30ft.; to carry newsprint paper. Engines, triple-expansion, 16in., 27in. and 44in. by 33in. stroke; constructed by the builders; trial trip, December 16th.

VICTORIA CITY, steamer; built by Wm. Gray and Co., Ltd., to the order of Sir William Reardon Smith and Sons, Ltd., Cardiff; dimensions, 400ft. by 54ft. 3in. by 28ft. 0½in.; to carry cargo. Engines, reciprocating engines of the balanced quadruple inverted type, pressure 260 lb. per square inch; constructed by the builders; trial trip, December 16th.

ACHIMOTA, twin-screw mail and passenger motor vessel; built by Harland and Wolff, Ltd., to the order of Elder, Dempster and Co., Ltd.; dimensions, 460ft. by 63ft. 6in. by 34ft. 6in. Engines, Harland-B. and W. Diesel engines; constructed by the builders; launch, December 17th.

DJEBEL-AURES, steel single-screw steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of La Compagnie de Navigation Mixte de Marseille; dimensions, 336ft. by 44ft. 9in.; to carry 3500 tons on a light draught. Engines, Parsons turbines; launch, December 17th.

MARON, twin-screw motor vessel; built by Caledon Shipbuilding and Engineering Company, Ltd., to the order of Messrs. Alfred Holt and Co., Liverpool; dimensions, 426ft. by 56ft. by 31ft. 9in.; to carry cargo and a few passengers. Engines, oil engines; constructed by North-Eastern Marine Engineering Company, Ltd.; launch, December 17th.

PORTREGIS, steel screw steamer; built by Craig, Taylor and Co., Ltd., to the order of Portfield Steamship Company, Ltd.; dimensions, 392ft. by 52ft. by 27ft. 6in.; to carry cargo. Engines, triple-expansion, 24½in., 41in., 67in. by 45in. stroke, pressure 180 lb. per square inch; constructed by Blair and Co., Ltd.; launch, December 17th.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Prospects for 1930.

PROSPECTS for the year 1930, as viewed by many Midland and Staffordshire industrialists, seem none too bright, and there is manifest in the area a disinclination to prophesy. The outlook is considered too obscure to justify optimistic forecasts, yet it is not sufficiently cloudy to warrant pessimism. On nearly all hands some improvement on the present volume of trade is looked for, but in the basic industries it appears to be founded more on faith than on discernible prospects. Midland industries from iron and steel downward are closely allied to the automobile engineering trade, and a continuance of the present healthy condition of this industry depends to a great extent upon the retention of the McKenna Duties. The doubt as to the action which the Chancellor of the Exchequer will take on Budget Day gives rise to much anxiety, and schemes of extension are being held up pending the receipt of the information. Industrialists generally are worried, too, at the prospect of possible increases in taxation. The opening of the year 1930 finds few branches of the Midland iron and steel producing trades in a position to see far ahead, and manufacturers here prefer to speak of the outlook for the quarter rather than for the year, developments in which are so much in the balance. Few industrialists are prepared even to hazard a guess at what may happen in Midland industries during the year. Some of the leading iron and steel producers, engineers, and manufacturers this week referred to the situation in their own particular trades. Conditions and prospects vary very much. In the constructional engineering industry there is little enough evidence of improving tendencies, and a continuance of the late quiet state of affairs seems probable. Electrical engineers are anticipating great development in their industry. Many electrical engineers hold substantial orders for power station equipment, and there is a growing field for electrical appliances of all kinds. Mechanical engineers hereabouts are not well placed, but they have been strengthening their position lately. Automobile engineers are at present busy, the commercial vehicles section being the best employed at the moment. Midland rolling stock makers have considerably improved their position, and have a fair amount of business with which to start the New Year. All the departments are steadily employed, and there is every prospect of a successful year. The heavy edge tool trade, which has been very slow for some time, is now improving, but the chief overseas buying markets do not promise, in the eyes of some authorities in the trade, the same support for British edge tools as was formerly the case. The machine tool trade is active, and likely to remain so, and that in some measure denotes activity in the Midland manufacturing shops. Heavy ironfounders in this district are moderately well placed, although the demands of the engineering trades are not heavy. Light ironfounders, as a result of quietness in the building trade, are not well employed, but prospects are good, there being no evidence of any slackening off of building in this area. Birmingham brassfounders are active, as are the stampers, and hopes are entertained of another prosperous year in 1930. Hardware and hollowware makers in this area are favourably placed for business, as are lockmakers. The coal mining industry in the Midlands, which has not had a prosperous year, commences 1930 in a state of uncertainty. The industry is perturbed by the possible effects of the Coal Mines Bill, with its provisions for the regulation of production, and the supply and sale of coal, and no relief can be expected until the fate of the Bill is determined. Iron and steelmasters and others engaged in heavy industries in which coal is an important raw material share the concern of the coalowners. Such a position of uncertainty is not, of course, conducive to that industrial confidence in the future which is necessary to progress. To sum up, though it is clear that hope is being backed by enterprise in Midland industries, there is little real sign of a revival of trade in the immediate future, and beyond that it is practically impossible to foresee what may happen.

Staffordshire Iron Trade Anticipations.

Business was unevenly distributed in the Staffordshire finished iron trade throughout the year 1929, and it would appear that similar conditions must rule during, at any rate, the opening quarter of the New Year. Ironmasters see no prospect of improving conditions in the Crown bar branches of the industry, but they are hopeful of a maintenance, if not an improvement, in the marked bar and strip departments. They express qualified optimism, and although they realise the obscurity of the general industrial outlook, they believe that the Staffordshire iron trade will be able during 1930 to hold its own. The quarterly meeting of the Midland iron trade which falls due next week is normally looked to for indications of the trend of trade, but judging by the conversations on 'Change in Birmingham this week Staffordshire ironmasters do not anticipate anything very tangible in the way of trade developments. Makers of best grade iron are fairly well placed for business, and though they cannot look far ahead recent experiences have led them to expect a regular inflow of orders sufficient to keep their books in a healthy condition. During the past year, production costs have advanced, causing considerable anxiety. It has been found possible, however, during recent months to get better prices for finished iron. The price of marked bars has advanced during the past year 10s. per ton, putting it back to the position it occupied in January, 1928. The appreciation would appear to be even greater in the case of Crown bars, for which the price quoted at the opening of the past year was £9 2s. 6d. to £10. To-day's quotation is £10 to £10 7s. 6d. The marketing position in this department of the iron trade is, however, very irregular and unsatisfactory, for while many makers are endeavouring to raise the selling value to the standard of £10 7s. 6d., others accept down to £10 in an endeavour to preserve for themselves some of the business which comes on to the market and a large proportion of which is, by reason of the lower prices asked, secured by makers outside this district. A standard of quality for Crown bars is what is needed to put this branch of the Staffordshire industry on its feet again. Were a specification of true Crown bars to be arrived at, Staffordshire makers assert that they would have much less difficulty in securing business. At present Crown bars are Crown bars, so to speak, and the order goes to the firm whose price is the lowest, irrespective of the fact that the material may or may not be of first-rate quality. The trade in common bars—that is to say, in bars as used by the bolt and nut and fencing trades—during the past year declined still further, until to-day, mainly as a result of intense foreign competition, it has sunk to negligible proportions. Selling prices of Staffordshire nut and bolt bars certainly advanced during the twelve months. In January, 1929, they were quoted £8 12s. 6d. to £8 17s. 6d., as against to-day's price of £9 to £9 5s. Makers are in no better position as regards the wresting of business from the foreigner than they were a year ago, and in many quarters it is considered that to-day's quotation is merely a nominal one, and that could makers see any prospect of getting orders they would not hesitate to make a considerable reduction. Ironmasters realise, however, the faintness of their chance against Belgian competitors, and they have more or less given up the unequal struggle. I am able to record further progress in wrought iron strip. The brightness which characterised it at the opening of the year has not been sullied, and to-day demand is every bit as good, if not better, than it was at this time last year. Tube mills are constantly calling for this material, the value of which has improved during the twelve months by 7s. 6d. to 10s. per ton. Moreover, the prospects are considered quite satisfactory, as the tendency towards the use of iron tubes is thought to be expanding.

Blast-furnacemen's Strong Position.

Midland smelters of pig iron have had a busy and prosperous year, and are looking forward to equally satisfactory conditions during 1930. It is high time, they assert, they had a run of luck. At the opening of the past year the pig iron situation was precarious, and blast-furnacemen had difficulty in hanging on to hope after a bad period of slack trade and low prices. During the year, however, the pendulum swung in the other direction until, at date, they are perhaps the most favoured of industrialists in this area. They have ample orders to carry them over the current quarter. New contracts are being fixed up at satisfactory rates, and with supply and demand approximating, they hold the whip hand in the market. The formation during the year of an association for the control of prices has further strengthened their hands, and while twelve months ago there was some price-cutting prevalent in the industry, smelters have not had to contend with anything in this nature since minimum selling prices were fixed by the Producers' Association, though not all the furnacemen in the area are members of the newly formed body. Up to now the state of the market has been such as to induce furnacemen to keep prices up. Whether makers outside the Association would consider it advisable, in the event of an excess of output over consumptive requirements, to ignore the combination and set their own level of values is problematical. There are consumers here, however, who contend that it only needs a surplus of pig iron to bring prices down again. In calculating the extent to which raw iron prices have risen during the past year, it must be borne in mind that whereas a year ago prices quoted were for iron at furnaces, to-day's quotations are for delivery at Black Country stations. In January last Derbyshire No. 3 foundry pig was selling at £3 per ton; to-day it commands £3 18s. 6d. Northamptonshire foundry, which was £2 15s. to £2 16s., is now £3 15s.; while North Staffordshire foundry, which sold at £3 2s. 6d., now makes £3 19s. 6d. This is truly an improvement, even when one sets off the increase in production costs due to the advance in prices of coke for the furnaces. In the forge iron department similar progress as regards business has not been made. There have been one or two small buying spurts, but the consuming industries hereabouts have been poorly employed, and the quantity of forge iron consumed has been below normal. Business in this department must be written down as dull, and while hopes are expressed of better trade in 1930, any enlivenment of demand has yet to make itself evident. Values have, during the past year, moved up in sympathy with foundry iron prices, and Northamptonshire forge material priced a year ago £2 11s. 6d. to £2 13s. 6d., is at date firm at £3 11s. Derbyshire forge, which stood at £2 18s., to-day commands £3 14s. per ton. Midland smelters are fortified and encouraged by the knowledge that they are in a much stronger position than that in which they usually find themselves at the opening of a year. Some anticipate a further advance in selling prices in the immediate future, and although users do not admit it, they would not be surprised at such a development. They know that many of the furnacemen have sold their output over the current quarter, and that they have of late refused to enter into longer date contracts. Smelters appear content to abide by the chances of the market which, so far, are in their favour.

Obscure Steel Outlook.

Steelmasters' anticipations for 1929 were only in part realised, for while at some periods of the year they did considerable business, much of it at the expense of the foreigner, at other times, including the latter portion of the year, they found business decidedly slack. Fluctuating prices of foreign steel have had much to do with the volume of business transacted at British steel works, for when continental prices have risen engineers and manufacturers have bought at home, while, such is the state of competition for business that as soon as foreign prices fell materially below those of local makers, orders were placed abroad again. The recent fall in foreign prices, combined with the enhanced costs of coke and other works fuel, have caused native steel masters' prospects gradually to fade. When they look ahead they are met by the prospects of further increases in fuel costs and the possibility of increased taxation. With little prospect of better prices to compensate them, many steel masters are inclined to take a somewhat gloomy view of the situation. Generally speaking, the year was an improvement on the last, but the immediate demand is weak, and though steel masters hope for an improvement in the near future, there are few really optimistic members of the industry. The Steelmasters' Association has continued its policy of giving preferential rates to those who confine themselves to the use of British steel, and the movement is said to have gained popularity during the year. Native steel prices are higher to-day than they were at this time last year, angles now being £8 7s. 6d., as against £7 17s. 6d.; joists, £8 10s., against £7 17s. 6d.; tees, £9 7s. 6d., against £8 17s. 6d.; and ship, bridge, and tank plates, £8 17s. 6d., against £8 12s. 6d. Midland constructional engineers' requirements were not up to the normal in 1929, and other heavy users of finished steel did not materially increase their consumption. Had it not been for the business taken from the foreigner, local steel masters would, it is thought, have had to report a worse year than last, instead of a slightly better one. In the half-products branch, the fight with the foreigner was keen and severe, and prices fluctuated considerably. Small bars, which a year ago were £7 15s. to £8, are now £8 2s. 6d. to £8 15s., while billets stand at about the same level as in January last. Local re-rollers fared rather well, but business has fallen away again. It is hoped that the action of the continental Cartel in regulating, from February next, the output of steel will result in higher continental values, and thus give native steel masters an opportunity of again successfully competing for steel orders. It is something that it has now been realised by the steel trade that production has gone ahead of demand, and if a new equilibrium can be found, profitable production for steel masters alike at home and abroad may be possible during the year 1930. Production can hardly be said to have yielded a good return to local steel masters during the past year.

Dull Conditions at Sheet Mills.

Midland galvanised sheet mills which twelve months ago were in a strong position, with two months' output booked, are in a bad way. Trade during the closing quarter of 1929 was extremely poor, and the works opened up after the Christmas holiday with hardly any carry-over of orders. The holiday period was prolonged in the hope of some accumulation of orders with which to commence the New Year, but few were forthcoming. None of the chief overseas markets show any real activity, and demands from users at home are of small dimensions. The slump in demand has brought about a corresponding fall in values, and 24-gauge corrugated sheets are to-day selling at £12 7s. 6d. per ton. This is 22s. 6d. per ton below the price ruling at the corresponding period of last year and 15s. below the selling value in January, 1928. The outlook is far from encouraging, and unless a revival in buying on export account makes itself evident in the near future, it is probable that many of the mills in this area will be compelled to cease operations. The manner in which millowners have lowered their prices in an endeavour to stimulate business shows their eagerness to keep plant at work. Had it not been for cheaper production costs, however, such reductions in sheet prices as have taken place would have been impossible.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

The Outlook.

CURRENT prognostications as to the outlook in the engineering industries for the New Year are generally cautious in character, although in several branches prospects are not unfavourable. Not all of the locomotive building works in Lancashire are able to look very far ahead, but in one or two instances order books are sufficiently good to ensure reasonably active conditions during the first six months. Similarly, conditions in the constructional engineering branch are not uniformly satisfactory, but several firms have a fair volume of work in hand, and the prospects of one in particular have been appreciably improved by the fact that work has now been started on an important job, the contract for which was placed with it some considerable time ago. Moreover, road improvement, bridge building, and reconstruction schemes in Lancashire are proceeding apace, and as many of them are comparatively big jobs, local engineering firms should benefit substantially. Unfortunately, with cotton mill prospects no brighter than they have been during the past few years, there seems to be little hope of more prosperous conditions among either boilermakers or millwrights in Lancashire. Prospects for heavy electrical engineering are regarded as satisfactory, and more active conditions obtain in respect of machine tool makers. As before, textile machinists will be compelled to rely largely on export markets for business.

Rail, Canal, and River Bridges.

Preliminary work has now been started on the new bridge, about 80ft. wide, to link Lancashire and Cheshire over the river Mersey at Northenden. The cost is estimated at £40,000, and the bridge, which will carry an important new main road, is expected to be completed in eighteen months. In addition to this, some details have now been issued by the Manchester City Engineer, Mr. J. B. Lloyd Meek, of the £800,000 road and bridge programme to be undertaken by Manchester Corporation this year as an unemployment relief measure. The proposals have been incorporated in a new parliamentary bill. Of the total sum, about £74,000 is to be spent on the construction of a viaduct to cross Tanyard Brow and the Gore Brook at Gorton; £15,500 on a bridge over the Manchester and Ashton-under-Lyne main canal near Iredine-street; £17,000 on one over the Rochdale Canal near Stotts-lane; and £13,000 on another over the Stockport branch of the Manchester and Ashton-under-Lyne canal near Gorton Reservoir. About £15,500 is to be spent on a bridge over the Great Central and Midland Joint Line at Wayland-road; £13,500 on one over the London and North-Eastern Railway at Nelstrop-road; and about £10,000 on the construction of a bridge over the Ashton branch of the London, Midland and Scottish Railway near Culcheth Brow. In addition, two bridge-widening schemes are to be carried out—one at a cost of about £10,000 over the Prestwich branch of the London,

Midland and Scottish Railway at Moss Bank, Crumpsall, and the other, at a cost of £4500, over the London and North-Eastern Railway at Lees-street. The remainder of the £800,000 it is proposed to spend on street works of various kinds.

A "Tube" for Manchester?

"Events in the next day or two will have an important bearing on the future of the scheme." This is the somewhat cryptic announcement made this week by Mr. T. Walker, Chairman of the Manchester Corporation Underground Railway Committee, regarding a scheme for the construction of an underground railway in Manchester which he outlined recently. No further information is forthcoming, but the abnormal congestion of traffic experienced in the city during the Christmas shopping weeks is advanced as a powerful argument in favour of the scheme, and the hope is expressed that it will be scheduled for a substantial Government grant.

Non-ferrous Metals.

With the sole exception of lead, which has registered a rather marked improvement during the past week, weakness has been in evidence in all sections of the non-ferrous metals market. Buying interest in respect of all classes of metals has, of course, been very seriously affected by holiday influences, though this factor does not in itself account for the losses sustained. In the early days of the present week some recovery was registered from the lowest point touched in the case of tin, but the loss on balance is still rather severe. An increase in stocks at British port warehouses has certainly made its influence felt. The demand in all sections of the copper market has been very poor, and although refined descriptions of the metal show little change on the week, the tendency has not been too strong, and in the case of standard brands a slight net loss has to be recorded. With regard to spelter, weakness is an unmistakable feature of this metal, and with relatively little support from the consuming end, values are at the moment of writing distinctly weak, and have further receded to below the £20 mark. Allowing for the holidays, lead has been about the most active section and the only one to make any show of strength, current quotations being the highest since about the middle of November.

Iron and Steel.

Business in the iron and steel markets here has naturally been seriously interrupted during the past week, and stocktaking operations are another factor to make for inactivity. Foundry iron makers, however, still take a somewhat optimistic view of the outlook, and a steady trade is looked for when the markets settle down again. In the meantime, prices are very firm at 77s. per ton for Derbyshire and Staffordshire iron, delivered equal to Manchester, about 95s. for Scottish, and 90s. for West Coast brands of hematite. Bar iron has been very dull, but prices are unchanged at £10 15s. per ton for Lancashire Crown quality, and £9 15s. for seconds. In steel, business has been virtually at a standstill, but rolling are expecting to secure orders for a fair tonnage, particularly from the locomotive and constructional trades, in the near future. Sections are firm at £8 7s. 6d. per ton, joists at £8 10s., tank plates at £8 17s. 6d., boiler plates at about £10, large bars at £9 7s. 6d., and small re-rolled bars at from £8 5s. to £8 7s. 6d. Some stiffening in the local market for foreign products is anticipated, but buying has been very slow during the past week, and for the time being prices are nominal and unchanged.

BARROW-IN-FURNESS.

Hematite.

The tone in the West Coast hematite pig iron market is maintained and the outlook for this year is much better than that of twelve months ago. Prices have stiffened considerably, and that is a sign of a better demand. The home trade continues to be very sound, and makers are well situated as regards contracts. The slightly better outlook in the steel trade will have its effect upon the demand for iron, as requirements by the rail departments will be heavier. Continental and American business remains about the same, with the cargoes mostly consisting of iron of stated analysis. The iron ore trade is steady and local mines are experiencing a regular demand from outside iron producers. Foreign ore is in fair demand, with prices a little easier. The steel trade is slightly better as regards the Cumberland producers, who are fixed up for about three months on South American and L. and N.E. Railway accounts. Barrow is also sharing in these contracts. Hoops continue to be in steady demand, mostly on overseas account.

SHEFFIELD.

(From our own Correspondent.)

Steel Trade Prospects.

WITH a few exceptions, the Sheffield steel works resumed operations on Monday, after a holiday which was, on the whole, rather longer than that of last year. Present prospects for the New Year suggest a continuance of trade on lines similar to those of the year which has just closed. The production of basic steel, which has enjoyed much activity of late, has again started well, but there is no improvement in acid steel in sight. The Templeborough and Rotherham works of the United Steel Companies are running nine or ten basic furnaces, and two or three acid furnaces, a state of employment which represents an increased output on the December average. The continuous wire rod mill at Templeborough, which has been fairly well employed for a considerable time, has orders on hand for future execution. At the works of the United Strip and Bar Mills, the bar mill position is satisfactory, but a great deal more work could be accommodated at the strip mill. There is severe competition in the lower qualities of strip. The old open-hearth milling shop at Stocksbridge is being closed, and work concentrated upon the new shop. In the past, there has not been enough work to keep both plants fully occupied, and the change will not make any difference to employment.

Special Departments.

The heavy forges of the city have a good deal of work on hand, and the same is true of various special departments, which are likely to have a good year. The demand for stainless steel, and its kindred materials, non-corrodible and heat-resisting steels, continues very good, and the avenues for the employment of these steels are continually widening. The same is true of cold-wrought steel. The builders of motor vehicles are making large demands upon Sheffield for stampings of various parts, and alloy steel, and the outlook in this direction is favourable. Although the call in respect of light cars has fallen off, the requirements for commercial cars and omnibuses show an improvement. The trade in magnet steel and magnets for wireless apparatus keeps up well, and Sheffield is supplying a large amount of material to the makers of electrical apparatus generally. Tool steel has enjoyed a fair year so far as home demand is concerned, but business with overseas has fallen off greatly during the last few years, owing to production in the markets themselves. It is noteworthy, however, that latterly there has been an increase in the exports of the best qualities. The past year was a good one for engineers' and mechanics' small tools, and this year should also be active. The outlook for agricultural and gardening tools is not bright, as last season was a quiet one, and retailers have considerable stocks left on hand. The prospects as to ordinary classes of steel, for general commercial purposes, are doubtful.

Redbourn Hill Works.

The works in North Lincolnshire which are largely devoted to the production of basic steel have had a year of much activity, not being affected by the quietude which was felt in other steel centres during some of the latter months. The promise of the New Year is good. A feature of the past year in this district was the reopening of the Redbourn Hill works, at Scunthorpe, belonging to Richard Thomas and Co., Ltd., which had been closed for three or four years. The programme started there eighteen months ago has now been completed, and the works are producing about 4500 tons of coke, 2500 tons of pig iron, and 3000 tons of steel sheet bars per week. One blast-furnace for the sheet bar mill has been completely remodelled. At the recent meeting of the company, the chairman stated that during the three or four years that the works had been idle £30,000 a year had been spent on keeping the plant and structure in repair, with the result that the place was now valuable as a going concern. During recent weeks the works had made a small profit, and he was confident that, unless something unforeseen occurred, that branch would now cease to be a drain upon the parent company's financial resources, and the recent heavy expenditure there would be fully justified.

An Ironworks to Close.

The last day of the Old Year brought a shock to Sheffield in the form of an announcement by the directors of William Cooke and Co., Ltd., of the Tinsley Steel, Iron and Wire Rope Works, Sheffield, that they had decided to close down entirely their wrought iron forge and bar mills department. Depression in the iron trade—largely attributed to the importation of cheap continental bars on an enormous scale—is responsible for this drastic step. The directors state that the department has made serious losses during the past nine years, which losses are still going on. "It has been thought," they say, "that so many wrought iron works closing—fifty-nine since 1913—would throw more trade into our hands, but this has not proved to be the case, as even now it is found impossible to work at more than 60 per cent. of the capacity." Messrs. Cooke employ altogether over 1000 men. Those affected by the stoppage, numbering 450—including many members of the general staff—have been given a month's notice. Most of the staff who remain will have to submit to reduced salaries. The company will continue to operate its other departments, namely, the wire ropery, which is now making profits, and the horseshoe department, which is holding its own.

Derbyshire Lead Mining.

I have previously referred to the new lease of life which has come to the famous Mill Close Lead Mines at Darley Dale, near Matlock, through the discovery of a new deposit of ore under the water level. For a long time the mines produced one-third of the total output of lead ore in the British Isles, but the main veins worked out last year, and the mines lost money. Then came the new discovery, and pumps were installed, which are keeping clear the lead area by raising 30,000,000 gallons of water per week. A recent report on the mine states that there has been a gradual improvement in the grade of ore worked, and it has been possible to develop the ore body below the 70 fathoms level from several points. The indications of the existence of a better grade ore being found at depth and over an increasing area continue to be promising.

The Lighter Trades.

The Christmas season demand in the cutlery and plate trades has been so large that the output has broken the record. This is to a large extent due to the enormous orders placed for goods for advertising and coupon distribution and to the increased requirements of the cheap bazaar trade. Stainless knives, scissors, forks, spoons and small plated articles have been distributed in huge quantities through these agencies. The general trade has been fairly good, and the volume of work on hand during the closing months has considerably exceeded that of the average of the year. Great quantities of stainless table knives have been turned out, and, although the preponderating share of the demand has been for the cheaper qualities, the firms who make only the highest grades have also enjoyed a good trade. There is usually a good demand for high-class pen and pocket cutlery. The scissors trade has had a much improved year, for which it has to thank the Marking Order to a considerable extent. The scissors used in ladies' fancy bags, manicure sets, and other outfits have in the past been largely bought from Germany, but, now that it is necessary that these articles should bear an indication of their country of origin, a great deal of the trade has come to Sheffield. The safety razor blade branch, although not experiencing quite such a good demand as a few months ago, is still turning out huge quantities of goods. There are about twenty makers of these blades in the city.

NORTH OF ENGLAND.

(From our own Correspondent.)

Back to Better Prospects.

THE wheels of industry in the North of England are once more in motion after the holidays. Industrialists and workers alike returned buoyed up by the knowledge that good employment is assured for some time ahead, and with every indication that there will be a steady expansion in trade. Much still remains to be accomplished before anything like a normal state of affairs is reached, but the conditions now prevailing in the iron and steel industry certainly offer grounds for hope that the corner has been definitely turned, and that 1930 will see some further advance along the path of industrial recovery. A most encouraging feature is that the Cleveland district has more than maintained its proportion of the total iron and steel export trade of the country. As a matter of fact, the iron and steel exports from Cleveland exceed those of any year since 1924, and have themselves only twice been exceeded since 1914. Moreover, this has been accomplished in spite of the fact that Cleveland is devoting less and less attention to raw pig iron as an exportable commodity. It is true that about 60,000 tons more iron was shipped last year than in 1928, and the increase is entirely confined to the foreign trade, Scotland's quota being reduced. But only twice before 1926 has so little pig iron been shipped from the Tees, and the 1929 tonnage is only equal to about 20 per cent. of the pre-war figure. The increased exports of manufactured iron and steel have again exceeded the million tons mark. The effect of the Indian steel tariff is reflected in a decline of nearly 50,000 tons in the volume of shipments to India, but there has been a corresponding expansion in the trade with South and East Africa.

Cleveland Iron Trade.

A survey of the Cleveland pig iron trade over the past year presents some extraordinary features. The output has been as high as, and probably slightly higher than, in any year since the boom period of 1920. The number of blast-furnaces now in operation is forty-one, as compared with thirty-one a year ago; prices are substantially higher, and surplus stocks at the makers' works are practically non-existent. Indeed, for several months the Cleveland ironmasters were so heavily sold that they withdrew entirely from the market, and consumers either had to purchase from the limited stocks which merchants had at their disposal, or seek supplies from other areas. These facts might convey the impression that the Cleveland ironmasters have had a fairly prosperous time, but this is far from being the case. Indeed, there was no direct profit on the great bulk of the iron made in this district. Much of it was sold at a loss, and the advance in prices during the year was not sufficient to cover the rise in the cost of fuel. In fuel alone there was an increased charge of 7s. to 8s. per ton in the cost of pig iron production, whereas the advance in the quoted price of the standard No. 3 G.M.B. grade was 6s. 6d. per ton. Thus from the economic standpoint the position of the Cleveland iron trade has not materially improved. No doubt a bigger output, by distributing standing charges over a bigger unit of production, has enabled some economies to be made, but during the summer months of the year, when the pressure for pig iron was at its maximum, definite limitations in the expansion of output were imposed by the lack of blast-furnace coke. The rise in the cost of coke was responsible for the inflation of pig iron prices, whilst the limitations of the fuel supply also had the effect of checking the further expansion of pig iron production during the summer months when the demand was at its maximum. At one time Cleveland pig iron was the cheapest in the world, but it would appear that that position has been definitely lost. Other areas, notably the Midlands, can now manufacture pig iron more cheaply, and in foreign markets, French, Belgian, and Luxemburg pig iron can easily undersell the Cleveland product. As a result the Cleveland producers have diverted more attention to the development of the steel trade, and the great bulk of the pig iron output has been consumed at their own steel manufacturing plants. Sales to the general body of home consumers have not materially increased, nor has there been any marked improvement in the export trade. But the needs of the steel works have been heavy and insistent, and the blast-furnaces have been largely occupied in meeting that need. That period of pressure has now passed, and outputs are on the decline. At the beginning of the year the standard quality of Cleveland pig iron could be bought at 66s. 6d., but at the close the price was 72s. 6d., which is much too high for the foreign consumer, and even too high to command a ready sale in the home markets.

Hematite Pig Iron.

In the East Coast hematite pig iron trade, too, the economic difficulties have largely offset the satisfaction derived from an increased output. For the greater part of the year producers sold below cost, and only in the last month could it be said that hematite makers were in a position to make ends meet. Rather curiously, 1929 ended as 1928 began, with thirteen blast-furnaces producing hematite on the North-East Coast, but the average number in blast has been substantially higher in 1929

than in the previous year. Beginning the year with nine blast-furnaces operating on hematite, the number gradually increased to a maximum of fourteen in July, and that number was reduced by one in November. Prices throughout the year steadily advanced, though makers affirm that the advances always lagged behind the rise in the value of raw material. However, the year closed with a minimum quotation of 79s., which represented a rise of 8s. per ton on the year. Moreover, contracts for hematite iron have been fixed for the first quarter of 1930 at 80s. and 81s. per ton, which should leave a modest margin of profit, in view of the easier tendency of raw materials.

Manufactured Iron and Steel Trade.

Official statistics are not yet available, but it is estimated that the steel production on the North-East Coast amounted to 2,?17,000 tons, the highest for over ten years past, with the exception of 1927, when 2,236,000 tons were produced. During the year prices ranged within narrow limits. At the close, quotations for the principal classes of rolled steel were somewhat higher than at the beginning of the year, but other descriptions were cheaper, and, moreover, in almost every case the increased price of fuel involved an advance in the cost of production. The expansion in output has been almost entirely due to the increased needs of home industry, and there is every indication that the trade will continue to develop steadily. Under the stimulus of State aid, further big development schemes are projected, and there is reason to hope that if in other directions enterprise be not stifled by oppressive taxation, the steel trade will continue to experience an active home market. In the meantime, the works on the North-East Coast have healthy order books, and are assured of active employment for some time ahead.

The Coal Trade.

The Northern coal trade closed the year with much improved conditions, and with good prospects. There is, however, considerable apprehension because of the present legislation. It is difficult to predict what the effect of this legislation is likely to have on the export trade. At the moment, coalowners have excellent order books, and are clearing their outputs, but there is a certain disquieting tendency for foreign buyers to delay placing contracts. A number of them believe that the export trade will be subsidised, and anticipate a reduction in export prices. At the same time, the sales that have already been made are most promising, and there is a strong tone about the market.

New Dry Docks.

Sir George Renwick, the Tyneside industrialist, is promoting a dry docks enterprise for the Tyne which it is expected will eventually provide work for some 3000 men. The site of the projected docks is the Renwick and Dalgliesh shipyard at Hebburn, and they will be among the largest on the North-East Coast. Two docks, each 600ft. to 700ft. long, are being planned, and it is expected that a start with the preliminary work will be made in the course of a few weeks.

SCOTLAND.

(From our own Correspondent.)

Holiday Influences.

BUSINESS in the steel, iron and coal markets has been affected to some extent by the Christmas and New Year holidays, and as a rule very quiet conditions ruled throughout.

Locomotive Contracts.

The North British Locomotive Company, Glasgow, has secured an order from the South African Railway Administration for eighteen Class 15 CA locomotives, the approximate cost of which is estimated at £126,000. In February last the same builders received an order from the same railway for thirteen locomotives at a cost of £7622 10s. each.

Shipbuilding.

The total output from the river Clyde during the year 1929 amounted to 222 vessels of 567,356 tons. The aggregate is comparatively good as post-war results go. In 1928 the returns showed an output of 229 vessels of 601,918 tons, which was the highest figure since 1920. It is probable that the amount of work in hand at the present time will be found to be greater than in January, 1929, but it is stated that orders in hand are not so plentiful. During the first six months of 1929 new contracts were scarce, but after August a considerable improvement was noticeable, which, it is hoped, may be maintained. For the third year in succession Lithgows, Ltd., of Port-Glasgow, return the largest output with eighteen vessels of 91,327 tons aggregate, while in the marine engineering department John G. Kincaid and Co., Greenock, head the list with an output totalling 137,550 I.H.P., an increase of no less than 74,230 I.H.P. compared with the year 1928. The output from the Tayside was below the figures for 1928, but the total from the Forth shipyards showed an increase of nearly 10,000 tons. A considerable amount of repair work was also carried out in the Forth yards, one concern alone having had over 500 vessels in hand for repair and survey.

Coal Distillation.

The Bussey coal distillation plant at Glenboig, near Glasgow, has been closed down for a period of two months. The existing plant, by which it was claimed that 600 tons of coal were daily converted into 400 tons of smokeless fue', 20,000 gallons of crude oil, and 15,000,000 cubic feet of gas, was officially declared open in July last. Since then it has been found necessary to enlarge the auxiliary plant for the distillation of oil. With the original plant only seven retorts could be operated, but when the works reopen in eight weeks time fourteen retorts will be in operation day and night. It has been stated that the Bussey Company hopes within two years to erect in Great Britain at least twenty plants equal in size to that at Glenboig, and thereby to employ in all about 50,000 men.

Steel and Iron.

Specifications for steel have not been copious of late, and the New Year holidays may in some instances be of longer duration than usual. Business has continued quiet in most branches, and owing partly to the holiday season nothing of fresh interest has occurred. Likewise, nothing fresh has been reported in the iron market. Bar iron remains stagnant and re-rolled steel at £7 12s., home and export, has been inactive. A number of pig iron furnaces are likely to be damped down for three weeks and perhaps longer.

Coal.

Very little fuel has been available for shipment during the past week, and with business still confined to prompt demands little or nothing has been done. Efforts have been entirely directed towards clearing commitments up to the end of the year, and the scarcity of fuel is such that some cargoes have had to be carried forward into this year. Prices were not tested and are therefore nominally unchanged.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

BUSINESS in the coal trade has not yet recovered from the disturbing effects of the holidays, and it will be next week at least before matters settle down. The tonnage position has to a very large extent contributed to the prolongation of the usual period of comparative activity at this time of the year. Immediately before Christmas the number of waiting steamers in South Wales ports was round about 55, and it was expected that during the Christmas vacation the number would be substantially added to, but bad weather held up additional arrivals. The result was that on Saturday last steamers waiting to berth totalled 51, with only two idle tipping appliances; but last week-end tonnage came along more freely, with the consequence that on Monday the waiting list was brought to practically 60 steamers, though on Tuesday the number was reduced again to 55. The loading pressure, as may be gauged from these figures, is particularly heavy, but more especially at Swansea. Collieries, generally, are so hard pressed for prompt supplies that new business for early loading is almost at a discount. The position of collieries is a very comfortable one for the next week or two at least. Tonnage continues to be taken up on a very fair scale, though, as may be imagined, outward rates of freight are very depressed owing to the amount of tonnage being offered for employment and the difficulty of arranging stems with the colliery undertakings. Shipments of coal, according to the Great Western Railway returns, were unusually good immediately before Christmas, as the total for the week ending December 22nd was over 758,000 tons, the highest quantity for any week since pre-war days, but for the following week the total was much reduced on account of the holidays and came to rather more than 352,000 tons. As from the beginning of the New Year, the output regulation provisions of the amended marketing scheme came into operation. Although no official statement has been issued so far, it is reported that the allocations issued to the collieries are based on an output of between 40 and 41 million tons per annum for the bituminous collieries and 5½ million tons per annum for anthracite collieries for the first quarter of the year, these figures being slightly in excess of the 1929 outputs.

Ebbw Vale Undertaking Developments.

Over the holiday period important developments took place in connection with the direction of the Ebbw Vale Steel, Iron and Coal Company, Ltd. It was officially announced that Sir Frederick Mills, Bart., D.L., had resigned from the boards of this and its subsidiary companies, and since then it is stated that Captain C. E. Benson has taken a similar step. The boards are in course of reconstruction. Sir John Beynon, who is a leading figure in the South Wales coal trade, has rejoined the board of the Ebbw Vale company and has undertaken the responsibilities of chairman and managing director. It is also understood that Mr. David H. Allan, senior partner of Messrs. Allan, Charlesworth and Co., chartered accountants, of Fenchurch-avenue, London, has accepted an invitation to fill one of the vacancies on the board, and another name mentioned as likely to be a director is Mr. Lionel Digby Whitehead, who was formerly on the board. Naturally, there is much speculation regarding the future of the undertaking. Rumour credits Sir John Beynon concentrating more on the coal production side of the undertaking rather than on the iron and steel side. As regards the latter, only one small blast-furnace is now in operation, all the steel works are idle, and only one of the rolling mills is working. The week-end immediately before Christmas about 500 notices were served on men in the bye-product section. These notices were dated to expire on January 4th, after which the men will be employed on day-to-day contracts. Sir John Beynon has appointed Mr. Trevor L. Mort, of the Fernhill Collieries, as his mining adviser. Mr. Mort is a director of the Fernhill Company and has been associated with the undertaking for over twenty years.

Steel, Tin-plate Items.

The largest blast-furnace in the country has recently been "blown in" at the Dowlais Steel Works, East Moors, Cardiff, belonging to Guest, Keen and Nettlefolds, Ltd. This furnace has a capacity of nearly 4000 tons output per week and is the most modern of its kind. Previously, these works possessed the largest blast-furnace in the British Isles, its capacity being 3700 tons output per week. It is still working regularly. Millmen numbering about 400 at the Morriston and Midland Tin-plate Works, Morriston, who stopped work over a fortnight ago as a protest against the use of Belgian steel bars, which they alleged to be inferior to British, decided to resume work on Monday last on the condition that their grievances were considered immediately by the Conciliation Board for the industry. The men, however, were unable to make a restart as they expected, owing to lack of supplies, &c. According to the management a resumption will not be possible until Monday next. Notices which were served over a month ago to the staff and workmen employed at the English Crown Spelter Works, Swansea, expired on Saturday last, but they were deferred for a week.

Lost Ship-repairing Order.

A fairly substantial ship-repairing order has been lost to this district in the case of the Cardiff-owned ship "Neville." This vessel stranded on the rocks at Sully, near Cardiff, during the recent gales, but was subsequently refloated and taken to the Cardiff pontoon of the Channel undertaking for the purpose of examination. Tenders were invited for the repairs, which are considerable, as practically the whole of the bottom of the ship will have to be renewed, besides 100 frames, repairs to the tanks and work on the stern frame, bow damage and rudder. As the result of the tendering the order has gone to Brigham and Cowan (Hull), Ltd., and the vessel has been removed by tugs to Hull.

Current Business.

The tone of the market is quiet owing to the unsettled conditions as the result of the holidays and the congestion in dock owing to so much tonnage arriving together. Actual business is confined to small parcels required for the completion of cargoes. The market is firm for most descriptions. Among large qualities drys and Monmouthshires are especially well placed, while of course smalls and sized coals are almost unobtainable. Patent fuel and coke is also extremely difficult to secure for early loading. It is reported that eight local colliery undertakings have quoted for the coal requirements of the Italian State Railways for delivery over 1930, the coals being almost entirely from the Monmouthshire area and best adapted for locomotive purposes. The railway authorities have had the offers for quite a time and are taking much longer to come to a decision than is usual. Pitwood continues to be steady for prompt supply, prices being round about 29s. to 29s. 6d.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

AMERICAN CAR AND FOUNDRY EXPORT COMPANY, of New York, asks us to announce that it has opened a London office at 25, Victoria-street, S.W. 1, and that the agency carried on by Messrs. Davis and Lloyd, of 26, Victoria-street, S.W. 1, ceased on December 31st, 1929.

BROWETT, LINDLEY AND CO., Ltd., of Sandon Works, Patricroft, Manchester, who have been in the receiver's hands on behalf of the debenture bond holders, are, we are informed, to be reconstructed early in the New Year, the scheme of reconstruction being already well in hand.

MONTREAL LOCOMOTIVE WORKS, Ltd., Montreal, Canada, asks us to announce that it has opened a London office at 25, Victoria-street, S.W. 1, and that the agency heretofore carried on by Messrs. Davis and Lloyd, of 26, Victoria-street, S.W. 1, ceased on December 31st, 1929.

FIAT BRITISH AUXILIARIES, Ltd., and FIAT BRITISH OIL ENGINES, Ltd., ask us to announce that they have removed their address from 43, Albemarle-street, W. 1, to 106, Fenchurch-street, London, E.C. 3. New telephone number, Monument 1938–9; and telegraphic address, "Fiatbraux, Fen, London."

CONTRACTS.

THE BRITISH THOMSON-HOUSTON COMPANY, Ltd., has received an order from the Great Northern Railway Company (Ireland) for a twelve months' supply of "Mazda" gas-filled electric lamps.

W. H. ALLEN, SONS AND CO., Ltd., of Bedford, have received an order for ten steam turbines and condensing plants for driving hot oil centrifugal pumps for the new oil cracking plant for the Anglo-Persian Oil Company, Ltd., at Abadan. The order was given through Perrins, Ltd., Astor House, Aldwych, who are the British representatives of the Kellogg Company, the makers of the hot oil pumps and the main contractors for the cracking plant.

CALENDARS, DIARIES, &c.

LEA RECORDER COMPANY, Ltd., 28, Deansgate, Manchester.—Desk memorandum pad.

LE GRAND, SUTCLIFF AND GELL, Ltd., Southall.—Wall calendar with daily tear-off slips.

C. A. PARSONS AND CO., Ltd., Heaton Works, Newcastle-on-Tyne.—Wall calendar with monthly cards.

FREDK. A. PERRY, Ormond House, 63, Queen Victoria-street, London, E.C. 4.—Wall calendar with daily tear-off sheets, on behalf of the Berliner Maschinenbau-Aktiengesellschaft, formerly L. Schwartzkopff.

SHAW AND BLAKE, Ltd., 8, Bell-yard, and 37, Surrey-street, London, W.C. 2.—Pocket diary.

HENRY SIMON, Ltd., 20, Mount-street, Manchester.—Wall calendar with daily tear-off sheets.

SIMPLEX CONDUITS, Ltd., Garrison-lane, Birmingham.—Pocket diary.

SPOTTISWOODE, BALLANTYNE AND CO., Ltd., 1, New Street-square, London, E.C. 4.—Wall calendar with monthly tear-off sheets.

STAVELEY COAL AND IRON COMPANY, Ltd., near Chesterfield.—Pocket diary and memorandum book.

SUPERMARINE AVIATION WORKS, Ltd., VICKERS (AVIATION), Ltd., ROLLS-ROYCE, Ltd.—Reproduction of a painting by Mr. A. Coombe Richards of the Schneider Trophy contest.

J. I. THORNYCROFT AND CO., Ltd., Thornycroft House, Smith-square, S.W. 1.—Wall calendar with monthly sheets.

JOHN TULLIS AND SON, Ltd., St. Ann's Works, Glasgow.—Desk diary.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
(1) Native	19/6 to 22/–
(1) Spanish	23/– to 24/–
N.E. Coast—	
Native	18/– to 21/–
Foreign (c.i.f.)	24/–

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	4 1 0	—
No. 1 Foundry	4 0 6	—
No. 3 Foundry	3 18 0	—
N.E. Coast—		
Hematite Mixed Nos.	3 19 0	3 19 0
No. 1	3 19 6	3 19 6
Cleveland—		
No. 1	3 15 0	3 15 0
Silicious Iron	3 15 0	3 15 0
No. 3 G.M.B.	3 12 6	3 12 6
No. 4 Foundry	3 11 6	3 11 6
No. 4 Forge	3 11 0	3 11 0
Mottled	3 10 6	3 10 6
White	3 10 6	3 10 6
Midlands—		
(3) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 15 6	—
„ „ Foundry	3 19 6	—
(3) Northampton—		
Foundry No. 3	3 15 0	—
Forge	3 11 0	—
(1) Derbyshire—		
No. 3 Foundry	3 18 6	—
Forge	3 14 6	—
(3) Lincolnshire—		
No. 3 Foundry	3 13 6	—
No. 4 Forge	3 9 6	—
Basic	—	—
(4) N.W. Coast—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 7 6 (*a*) / 4 9 6 (*b*) / 4 13 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. Coast—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
Lancs.—		
Crown Bars	10 15 0	—
Second Quality Bars	9 15 0	—
Hoops	13 0 0	—
S. Yorks.—		
Crown Bars	11 0 0	—
Best Bars	11 10 0	—
Hoops	12 0 0	—
Midlands—		
Crown Bars	10 0 0 to 10 7 6	—
Marked Bars (Staffs.)	12 10 0	—
Nut and Bolt Bars	9 0 0 to 9 5 0	—
Gas Tube Strip	11 2 6	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates (Marine)	10 10 0	10 10 0
„ „ (Land)	10 0 0	10 0 0
Ship Plates, ½in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	9 0 0	8 15 0
Sheets (Gal. Cor. 24 B.G.)	13 0 0	12 15 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
„ „ (Land)	10 0 0	—
Joists	8 10 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. Coast—		
Barrow—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	—
Billets	6 15 0 to 9 10 0	—
Manchester—		
Bars (Round)	9 7 6	—
„ (Small Round)	8 5 0 to 8 7 6	—
Hoops (Baling)	10 0 0	9 15 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
„ (Lancs. Boiler)	10 0 0	—
Sheffield—		
Siemens Acid Billets	9 10 0 (basis)	—
Hard Basic	9 2 6 and 9 12 6	—
Intermediate Basic	7 12 6 and 8 2 6	—
Soft Basic	6 15 0	—
Hoops	9 15 0 to 10 5 0	—
Soft Wire Rods	8 0 0	—
Midlands—		
Small Rolled Bars	8 2 6 to 8 15 0	—
Billets and Sheet Bars	6 5 0 to 6 12 6	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	12 7 6 to 12 15 0	—
Angles	8 7 6	—
Joists	8 10 0	—
Tees	9 7 6	—
Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 12 6	—

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	18/9 to 19/–
Block Tin (cash)	178 2 6
„ (three months)	181 12 6
Copper (cash)	67 17 6
„ (three months)	67 5 0
Spanish Lead (cash)	21 18 9
„ „ (three months)	21 10 0
Spelter (cash)	19 12 6
„ (three months)	20 5 0
Manchester—	
Copper, Best Selected Ingots	76 0 0
„ Electrolytic	83 15 0
„ Strong Sheets	110 0 0
„ Tubes (Basis Price), lb.	0 1 3
Brass Tubes (Basis Price), lb.	0 1 1
„ Condenser, lb.	0 1 3
Lead, English	23 7 6
„ Foreign	21 17 6
Spelter	20 5 0
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

Tungsten Metal Powder	3/4½ per lb.
Ferro Tungsten	3/1½ per lb.

	Per Ton.	Per Unit
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 0 0	7/6
„ „ 6 p.c. to 8 p.c.	£22 0 0	6/6
„ „ 8 p.c. to 10 p.c.	£21 17 6	6/–
„ „ Specially refined		
„ „ Max. 2 p.c. carbon	£33 0 0	10/–
„ „ „ 1 p.c. carbon	£39 0 0	15/–
„ „ „ 0·70 p.c. carbon	£41 0 0	15/–
„ „ „ carbon free	1/– per lb.	
Metallic Chromium	2/6 per lb.	
Ferro Manganese (per ton)	£13 15 0 for home; £13 10 0 for export	
„ Silicon, 45 p.c. to 50 p.c.	£11 10 0 scale 5/– per unit	
„ „ 75 p.c.	£19 0 0 scale 7/– per unit	
„ Vanadium	12/10 per lb.	
„ Molybdenum	4/2 per lb.	
„ Titanium (carbon free)	1/– per lb.	
Nickel (per ton)	£170 to £175	
Ferro Cobalt	9/6 per lb.	

FUELS.

SCOTLAND.

(*Prices not stable.*)

	Export.
Lanarkshire—	
(f.o.b. Glasgow)—Steam	14/–
„ „ Ell	16/6
„ „ Splint	16/9 to 18/–
„ „ Trebles	17/6
„ „ Doubles	17/–
„ „ Singles	14/6
Ayrshire—	
(f.o.b. Ports)—Steam	14/6
„ „ Jewel	17/6
„ „ Trebles	17/6
Fifeshire—	
f.o.b. Methil or Burntisland—Steam	15/– to 16/6
Screened Navigation	18/– to 19/6
Trebles	18/6 to 19/6
Doubles	17/– to 17/6
Singles	15/–
Lothians—	
(f.o.b. Leith)—Best Steam	15/–
Secondary Steam	14/3
Trebles	18/–
Doubles	16/6
Singles	14/9

ENGLAND.

(8) N.W. Coast—	
Steams	21/6 to 23/–
Household	38/– to 51/–
Coke	27/6
Northumberland—	
Best Steams	17/3 to 17/6
Second Steams	16/–
Steam Smalls	11/3
Unscreened	13/– to 13/6
Household	25/– to 37/–
Durham—	
Best Gas	17/–
Second	15/– to 15/6
Household	25/– to 37/–
Foundry Coke	25/– to 30/–

	Inland.	Export.
Sheffield—		
Best Hand-picked Branch	26/6 to 28/–	—
Derbyshire Best Bright House	21/– to 23/–	—
Best House Coal	20/6 to 21/6	—
Screened House Coal	18/6 to 20/–	—
„ „ Nuts	16/6 to 18/–	—
Yorkshire Hards	15/6 to 17/–	—
Derbyshire Hards	15/6 to 17/–	—
Rough Slacks	9/– to 10/–	—
Nutty Slacks	7/6 to 8/6	—
Smalls	3/– to 5/–	—
Blast-furnace Coke (Inland)	17/– on rail at ovens	
Furnace and Foundry Coke (Export), f.o.b.		24/– to 24/6

(9) SOUTH WALES.

Cardiff—	
Steam Coals:	
Best Smokeless Large	20/– to 20/3
Second Smokeless Large	18/9 to 20/–
Best Dry Large	20/6 to 21/–
Ordinary Dry Large	20/– to 20/6
Best Black Vein Large	18/6 to 18/9
Western Valley Large	18/– to 18/3
Best Eastern Valley Large	17/9 to 18/3
Ordinary Eastern Valley Large	17/6 to 17/9
Best Steam Smalls	14/3 to 14/9
Ordinary Smalls	13/– to 14/–
Washed Nuts	19/6 to 32/6
No. 3 Rhondda Large	20/3 to 21/–
„ „ Smalls	15/6 to 16/–
No. 2 „ Large	17/3 to 17/6
„ „ Through	15/6 to 16/6
„ „ Smalls	14/3 to 14/9
Foundry Coke (Export)	32/6 to 37/6
Furnace Coke (Export)	30/– to 32/6
Patent Fuel	22/– to 22/6
Pitwood (ex ship)	29/– to 29/6
Swansea—	
Anthracite Coals:	
Best Big Vein Large	36/– to 38/–
Seconds	30/– to 32/6
Red Vein	26/– to 28/–
Machine-made Cobbles	43/6 to 45/6
Nuts	45/– to 47/6
Beans	28/– to 30/–
Peas	20/– to 20/6
Breaker Duff	10/6 to 11/–
Rubbly Culm	12/9 to 13/6
Steam Coals:	
Large	20/– to 21/–
Seconds	18/– to 19/–
Smalls	13/– to 14/–
Cargo Through	15/6 to 16/6

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate: Joists (minimum), 12/6; Ordinary Ship, Bridge and Tank Plates and Sections, 10/– if home consumers confine purchases from associated British Steel Makers.

French Engineering Notes.

(From our Correspondent in Paris.)

Colonial Exhibition.

THE present year will be one of activity in preparing for the International Colonial Exhibition, which will be held in the Bois de Vincennes in 1931. The British Government has announced its intention of building a large pavilion, and all other countries possessing colonies will be represented. It is expected that this will be by far the greatest and most interesting colonial exhibition yet held. This is the first time that an exhibition has been held outside Paris. The transport of visitors, therefore, created a serious problem, and while the most will, no doubt, be made of the motor omnibus in conjunction with the Metropolitan Railway, the traffic will be dealt with chiefly by the railway from the Bastille to Vincennes belonging to the Cie de l'Est. It was proposed to incorporate that line into the Metropolitan system and to operate it electrically.

Rolling Stock.

The Cie du Nord has just turned out a new type of all-metal coach which is to be employed on the Paris suburban lines, and particularly between Paris and the airway terminus at Le Bourget. Its construction is similar to that of the coaches on the *rapide* trains, the outer body being of welded sheet steel with an inner casing of duraluminum, between which there are two layers of cork separated by an air space. The length of the car is 32ft. On the train that will run between Paris and Le Bourget there will be no changing of locomotives from back to front on the return journey, but the driver will take his stand in a cab in the leading coach and will control electrically the locomotive levers at the rear. At the same time there will be telephone communication with loud speakers between the driver and the fireman. While locomotive and wagon builders have a good deal of work in hand, it is now learned that they are disappointed over the failure to secure further orders from Rumania in addition to those valued at 40 million francs that were distributed in return for the loan which that country was authorised to raise in France. Since then all the French tenders for Rumanian rolling stock have been refused.

Canalising the Rhine.

When the French undertook to construct the lateral canal in Alsace they inherited a scheme which the Germans had proposed as an alternative to canalising the Rhine between Strasburg and Basle. The canal was decided upon because it was assumed that a waterway could not be assured of financial success unless it produced electrical energy, and at that time turbines were not efficient enough for the low heads of water available on the Rhine. Since then the improvements in turbines have entirely changed the outlook so far as canalising the river is concerned, and when the French began the works at Kembs the German and Swiss authorities carried through negotiations for a joint participation in a scheme which is intended to insure uninterrupted water communication with Central Europe by way of the Rhine, Lake Constance and the Danube. The French have always assumed that the canalisation scheme is impracticable. The decision of the Swiss Federal Council last week in favour of carrying out the Rhine works has, therefore, come as a surprise. It puts an end to a controversy that has been in progress for a very long time. The Rhine will be canalised, and the Alsace Canal will only be justified in the event of its offering substantial advantages. Good progress has been made with the canal at Kembs, and the French declare that they are determined to carry it through.

River Protection Works.

Alpine rivers cause great damage when freshets roll down boulders and raise the beds and often change them and the floods are disastrous to the surrounding country. Many suggestions have been made for overcoming the trouble with the Isère, Drac and Romanche, one of the proposals being to install stone crushing mills so that the boulders could be reduced to a size small enough to be washed along the river bed. The authorities have come to the conclusion that the only practical remedy is to improve the existing methods of dredging and raising and strengthening the banks. Considerable dredging is to be carried out in the Isère above Grenoble. Where the flat country is protected by reinforced banks an efficient system of drainage will be installed to deal with the water that percolates through the base. Certain areas will be arranged to serve as reservoirs in times of flood. An expenditure of 220 million francs upon the carrying out of this programme is now awaiting the sanction of Parliament.

Traffic Problems.

Of the methods that have been tried for dealing with the traffic problem in Paris the only one that has given practical results is the one-way traffic, which has now become general over the central part of the city. It reduced the congestion for a time by accelerating the vehicles, but the number of motor cars is increasing so rapidly that other measures are urgent. One of them prohibits the standing of cars within certain areas. This has become so unpopular for fear that it will affect the interests of shopkeepers, that the Municipal Council has requested the Prefect of Police to postpone the new regulation until it is able to complete arrangements for the construction of underground garages. The suggestion was first made by the Automobile Club of France, which offered to carry through the scheme. Each garage underground will hold several hundred cars, and it is claimed that the cost of constructing the garages will be covered in less than two years by the saving it will effect to the town.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

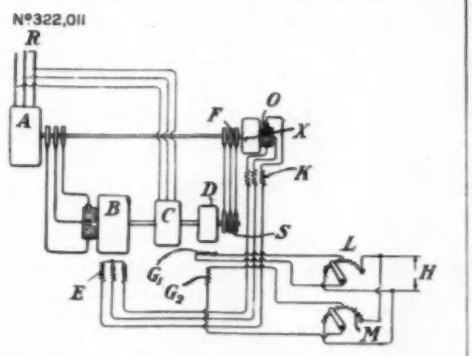
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

DYNAMOS AND MOTORS.

322,011. September 5th, 1928.—REGULATING THE SPEED OF ASYNCHRONOUS MOTORS, *The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2.*

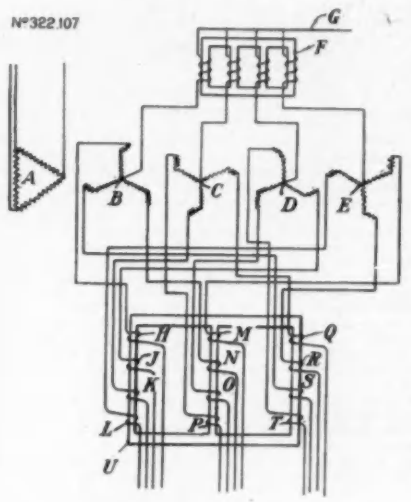
This invention relates to a scheme of regulating the speed and the power factor of asynchronous motors by means of a commutator machine mounted in cascade and excited by a frequency changer constructed in such manner that its rotor winding supplies the component of tension equilibrating the ohmic drop in the excitation windings, whilst the windings arranged on the stator supply the component of tension equilibrating the inductive drop in the same excitation windings. The object of the present invention is: (1) A special method of supplying the frequency changer by means of an alternator actuated by a synchronous machine branched on the network; (2) a method of amplifying the exciting current supplied by the frequency changer by means of a commutating generator rotating at a speed substantially proportional to the slip of the main asynchronous motor; and (3) to cause the speed of an asynchronous motor to vary automatically in respect of the load. A indicates the asynchronous motor, the speed of which it is desired to regulate and which is mounted or connected in cascade with a commutating machine B. This machine B comprises a compensating winding connected in series with the armature and an exciting winding E. The commutating machine B is operated by a synchronous motor C branched on to the same supply network R as the asynchronous motor A. On the same shaft is mounted an alternator D with rotating armature and with the same number of poles as the motor C. This alternator is provided on its stator with two induction windings G_1 and G_2 arranged in quadrature and supplied respectively from a source of continuous current H through potential rheostats L and M. By means of these rheostats the field of the alternator D can be varied as regards magnitude and phase. Owing to this arrangement it is possible to obtain at the slip rings S forming the armature terminals of the alternator D a tension at the frequency of the supply network of the motor A, the magnitude and phase of which may be regulated as desired. This tension is applied to collector rings F of a frequency changer X mounted on the shaft of the asynchronous motor A and having the same number of poles. The stator of this frequency changer comprises a polyphase winding K in series with the brushes O which rest on the commutator of the frequency changer, and the positioning of the brushes is arranged in such a manner that the winding of the stator may be in quadrature with the winding of the rotor with which it is connected. The circuits thus constituted serve to feed the exciting windings E of the commutating machine B. The flux of the frequency changer is proportional to the tension applied to the rings F. The tension obtained on the commutator side by the brushes O retains the same value as the tension applied to the rings F, but it has the slip frequency of the asynchronous motor. The electric motive force originating in the windings K has the same frequency and is proportional to the product of the flux and the slip frequency. The tension applied to the exciting windings E has thus two components: one, originating from the rotor of the frequency changer, and which supplies the ohmic drop of the exciting current; and the other, originating from the stator winding K, supplies the inductive drop of the same exciting current. The excitation current and consequently the flux of the commutating machine B therefore depends as to magnitude and phase upon the excitation of the continuous current of the alternator D. It is thus possible to regulate by means of the rheostats L and M the speed and the power factor of the asynchronous motor A. It should be observed that the phase of the electromotive force of the alternator D is also a function of the angle between the axis of the flux through the armature and the axis of the induction pole of the asynchronous motor C, and is therefore capable of variations at the same time as the load of the commutating machine B, which itself depends upon the load of the asynchronous motor A. It has been found, however, that such variation takes place in a favourable sense. —*November 28th*, 1929.



TRANSFORMERS AND CONVERTERS.

322,107. December 4th, 1928.—ELECTRIC TRANSFORMERS, The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2; and John Carley Read, of 14, Dunchurch-road, Rugby, Warwick.

This invention relates to transformer connections for supplying electric arc rectifiers with twelve-phase current, and its object is to effect more perfect twelve-phase balance of the currents in a cheaper way than by methods hitherto known. A is the primary winding of the main three-phase transformer. The secondary windings are divided up into four symmetrical three-phase stars B C D E, respectively, the neutral points of the latter being connected to interphase transformer F. This interphase transformer has four legs, each carrying a winding in series with one of the four star points, and these four windings are connected together at the common star point G which forms the negative pole of the direct-current system. The twelve secondary windings of the main transformer are lettered consecutively from H to T in the diagram in the order of their phase sequence. They are connected in series with a second interphase transformer U having three legs, each of which carries four windings which are respectively in series with four secondary phases 90 deg. apart. From the other ends of these windings the current passes to the anodes of the rectifier. It will be recognised that interphase transformer U offers high impedance in the anode current circuit to all harmonics which are multiples of 4 except those that are multiples of 12, and that the interphase transformer F offers high impedance in the anode current circuit to all harmonics that are multiples of 3 except those that are multiples of 12. This results in a stepped wave form of the anode current, which produces well-balanced twelve phase operation.—*November 28th*, 1929.



ELECTRICAL APPLIANCES.

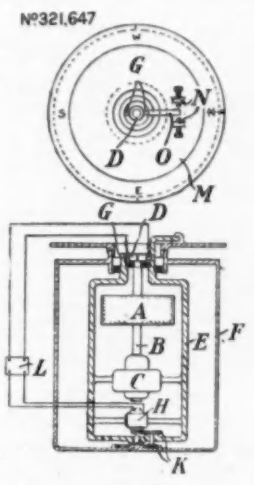
305,015. November 21st, 1928.—BRUSH HOLDERS FOR DYNAMO-ELECTRIC MACHINES, Société Anonyme des Etablissements Ducellier, of 23, rue Alexandre Dumas, Paris (Seine Department), France.

The object of this invention is to provide a brush holder for dynamo-electric machines in which the brush A is adapted to slide within a socket in which it is retained by a cap member B of pressed metal, the edges D of which are turned down to form an enclosure housing, one end of the spring urging the brush against the commutator. It will be seen that the invention is distinguished from known arrangements by the manner of positioning and fixing the cap on to the brush holder. The new arrangement also facilitates mounting and dismounting the brush.—*November 28th*, 1929.

MEASURING AND TESTING INSTRUMENTS.

321,647. June 13th, 1928.—APPARATUS FOR MEASURING THE STRENGTH AND DIRECTION OF MAGNETIC FIELDS, John Graham Binny, of 31, Redcliffe-square, London, S.W. 10.

This invention relates to a new apparatus for measuring the strength and direction of magnetic fields, such as terrestrial magnetism, and the object of the invention is to provide direction-indicating apparatus which will be more certain and

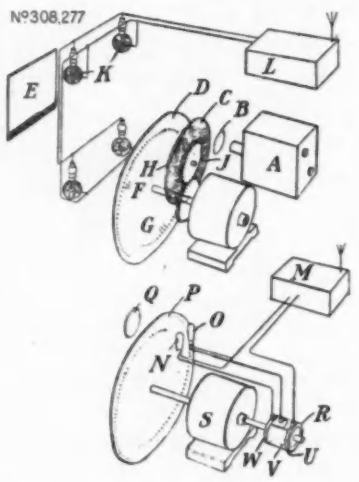


reliable than the magnetic needle or gyro-compass, and which will be suitable for such duties as the automatic steering of a ship where a strong directive force is required. The apparatus comprises a coil A mounted upon a rotary support B driven directly by the spindle of an A.C. motor C. The coil A is wound like one of the coils of the drum-wound armature of a two-pole dynamo electric machine, and is connected across two semi-circular segments of a simple commutator D fixed to the spindle. The spindle is journalled at its upper end in a revoluble casing E, journalled in a fixed outer casing F at its upper and lower ends. The revoluble casing carries at its upper end two brushes G and also supports the motor C and the turning motor H, adapted to turn the revoluble casing, hence the brushes and motors, *viâ* suitable gearing, such as toothed wheels and a fixed rack K. By this means any stray magnetic effects from the motors will be kept constant with relation to the direction of the brushes G. The brushes are connected through a relay L of the moving coil type, to the turning motor H. If desired, the relay may also be mounted inside the revoluble casing E. A compass card M is mounted on the fixed outer casing F on bearings, so as to be rotatable, and is provided with two adjustable screws N, mounted to act as a lost motion connection. A projecting arm O from the revoluble casing E rides between the adjustable screws, so that on rotation of the casing E the card will be carried round. The direction of the horizontal component of the earth's field can be determined by the point at which the generated E.M.F. reverses, and the brushes and relay are so set that the turning motor H overruns the point of reversal of the current generated, and is reversed by the operation of the relay when the reversed current has grown to a predetermined value. In this way the system will hunt the true direction. The relative speed of the motor C and the turning motor M is such that the variation of the torque of the motor C due to the relative movement of its stator and rotor by the turning motor H will not be appreciable. The angle through which the system moves on each side of the true direction may be as much as 10 deg. or more, and the lost motion connection is adjusted so that its angle of play is equal to this angle. It will then be repeatedly adjusted to the true direction as the brush system swings.—*November 13th*, 1929.

MISCELLANEOUS

308,277. March 20th, 1929.—ELECTRICAL TRANSMISSION OF PICTURES, *The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C.* 2.

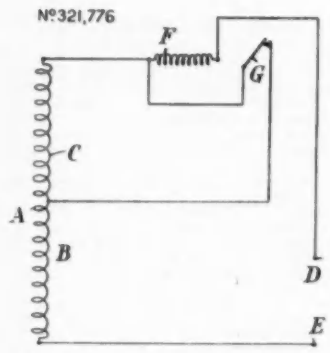
The picture-transmitting apparatus described in this specification includes a light source, which is enclosed within a casing A and is arranged to project light through a lens B, a multi-coloured disc C, and a perforated screen D, upon a picture E. The screen D is provided with two spiral-shaped groups of perforations F and G, and is coupled to the shaft of a driving motor. The disc C is provided with different coloured semi-circular segments H and J, which are coupled to the shaft of the motor through gears. The relation between the groups of perforations in the screen D is such that light is transmitted through the perforations F to a group of elemental areas distributed over the entire surface of the picture, and is transmitted through the perforations G to a group of elements which are also distributed over the entire picture, but lie between the elements to which light is transmitted through the perforations F. Thus, if the screen D and disc C are rotated in opposite directions at the same speed, the light is applied to one group of elements of the picture through the segment J, and the perforations F and to another group of elements of the picture through the segment H and the perforations G. The light impulses reflected from the picture E are received by the light sensitive elements K, which convert them into electrical impulses. These electrical impulses



are utilised to modulate the output current of a radio transmitter L through which they are transmitted to a radio receiver M connected to suitable different coloured lamps N and O, from which light modulated in accordance with the transmitted impulses is projected through a perforated screen P and a lens Q. It will be apparent that the screen P is similar to the screen D of the picture transmitting apparatus; that any suitable means may be utilised to maintain synchronism between the movable parts of the picture transmitting and receiving apparatus; and that the received picture may be either viewed on the lens Q or projected on a screen—not shown. In order that light of one colour may be projected through one group of perforations in the screen P and light of another colour may be projected through the other group of perforations, a commutator R is mounted on the shaft of the motor S, which drives the screen P. This commutator is provided with a slip ring U connected to one terminal of the radio receiver M, with a segment V connected to the slip ring U and arranged to complete the connections of the lamp O, while one group of perforations is passing the lamps, and with a segment W connected to the slip ring U and arranged to complete the connections of the lamp N when the other group of perforations is passing the lamps. Under these conditions, alternate elemental areas of this picture are reproduced in colours, corresponding to the colour lamps N and O.—*November 21st*, 1929.

321,776. October 1st, 1928.—THERMOSTATICALLY CONTROLLED PROTECTIVE DEVICES FOR ELECTRICAL APPARATUS, Siemens Brothers and Co., Ltd., of Caxton House, Tothill-street, London, S.W. 1, and Frederick James Gee, of "Blencathra," Bean-road, Bexley Heath, Kent.

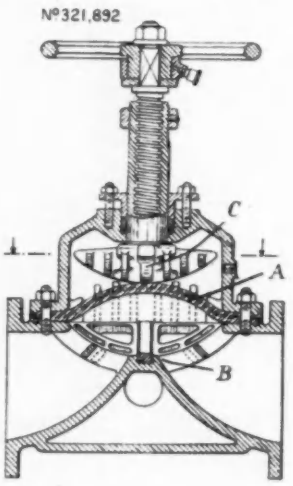
This invention relates to thermostatically controlled protecting devices for electrical apparatus, and more particularly to devices in which the thermostatic element is heated proportionally to the current or load of the electrical apparatus. A heating coil carries current proportional to the load on the apparatus to be protected, and heats a fluid having a high co-efficient of expansion contained in a bellows-like expansion chamber, the expansion of the fluid causing the operation of a quick-acting switch. The heating element is represented at A and comprises two coils B and C connected in series across terminals D and E. These terminals are for the convenient connection of the device in the circuit of the apparatus to be protected. If the current flowing in the circuit is direct, the device is preferably connected in a shunt to the main circuit. If the current is alternating current, the terminals may be connected to the secondary winding of a current transformer. In series with the heating element A is the winding of a relay F, this being connected between the coil C of the heating element and terminal D. A contact G of the relay normally closes a short circuit about coil C of the heating element. When normal or less than normal



load current is flowing the current in the winding of the relay F is not sufficient to cause the relay to operate, and as only a light current is flowing in the coil B of the heating element, the switch controlled by the thermostatic device will not be operated. As the load current increases, so will the current in the heating element increase, but the thermostatically controlled switch will only be operated after a considerable time, unless the load current reaches a high value. When the current through the coil B reaches a predetermined value, the relay F operates and by opening its contact G switches into circuit coil C of the heating element. Heating current now flows through both coils of the element A, and the heating effect for the load current of this value is substantially increased, thereby causing the device to operate after a shorter period than it would otherwise do had the heating effect not been increased.—*November 21st*, 1929.

321,892. February 14th, 1929.—DIAPHRAGM VALVES, P. K. Saunders, 98, Beresford House, Main-street, Johannesburg, South Africa.

In this valve a diaphragm A is used for closing purposes. It is made of rubber and is forced down on to a seating B by



the screw-operated sector-shaped piece C. The seating is described as a shallow weir and has a rubber insertion at the top to prevent the rubber of the diaphragm sticking to the metal if the valve is kept closed for a long time. The specification includes many other minor details.—*November 21st*, 1929.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

THE INSTITUTION OF ELECTRICAL ENGINEERS.—Savoy-place, Victoria Embankment, London, W.C. 2. Meter and Instrument Section Meeting. "Instrument Transformers," by Mr. J. G. Wellings and Mr. C. G. Mayo. 7 p.m.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, Westminster, S.W. 1. Thomas Lowe Gray Lecture, "Progress in Marine Engineering," by Eng. Vice-Admiral R. W. Skelton. 6 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—At 39, Victoria-street, S.W. 1. Informal meeting. Lecture, "Speedy Draughtsmanship," by Mr. F. T. Wood. Slides and demonstration. 7.30 p.m.

PHYSICAL SOCIETY.—At the Imperial College of Science and Technology, South Kensington, S.W. 7. Discussion on Examinations in Practical Physics, in which members of the Science Masters' Association will participate, will be opened by Dr. L. F. Richardson, F.R.S. Professor W. Wilson, F.R.S., Mr. J. H. Brinkworth, Mr. Maxwell, Dr. Barton and Mr. F. A. Meier will contribute to the discussion. 4.45 p.m.

SATURDAY, JANUARY 4TH.

ROYAL INSTITUTION OF GREAT BRITAIN.—In the Lecture Theatre of the Institution of Electrical Engineers, Savoy-place, Victoria Embankment, W.C. 2. Christmas Lectures Adapted to a Juvenile Audience, "How Things were Done in Ancient Egypt: iv., Boats and Furniture," by Mr. S. R. K. Glanville. 3 p.m.

MONDAY, JANUARY 6TH.

BRADFORD ENGINEERING SOCIETY.—The Technical College, Great Horton-road, Bradford. "The Constant-pressure Steam Accumulator," by Mr. C. F. Wade. 7.30 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS: WESTERN CENTRE.—Merchant Venturers' Technical College, Bristol. "Organisation of Public Service Motor Vehicle Repairs and Maintenance Systems," by Mr. W. Lewis Morgan. 7 p.m.

RAILWAY CLUB.—57, Fetter-lane, London, E.C. 4. "Notes on Railways of the Near East," by Mr. A. St. G. Walsh. 7.30 p.m.

SURVEYORS' INSTITUTION.—12, Great George-street, Westminster, S.W. 1. "Town Planning of Built-up Areas," by Mr. W. Townend. 8 p.m.

THE SOCIETY FOR THE PROTECTION OF ANCIENT BUILDINGS AND THE NATIONAL TRUST.—In the Hall of the Royal Society of Arts, John-street, Adelphi. "Windmills in Holland," by Mr. Jan den Tex; also Mr. R. Wailes will speak on the "Development of the English Windmill." 8 p.m.

WOLVERHAMPTON AND DISTRICT ENGINEERING SOCIETY.—The Victoria Hotel, Wolverhampton. "An Up-to-date Electric Drive for a Reversing Mill," by Mr. W. E. Taylor. 7.30 p.m.

TUESDAY, JANUARY 7TH.

INSTITUTION OF AUTOMOBILE ENGINEERS.—At the Royal Society of Arts, John-street, Adelphi, W.C. 2. "Roller Bearings," by Mr. T. W. Cooper. 7.45 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Graduates' meeting, Broadgate Café, Coventry. "The Rigid Six-wheeled Vehicle," by Mr. J. R. Harnott. 7.15 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—In the Lecture Theatre of the Institution of Electrical Engineers, Savoy-place, Victoria Embankment, W.C. 2. Christmas Lectures Adapted to a Juvenile Audience. "How Things were Done in Ancient Egypt: v., The Workshops," by Mr. S. R. K. Glanville. 3 p.m.

TUESDAY TO THURSDAY, JANUARY 7TH TO 9TH.

PHYSICAL SOCIETY AND OPTICAL SOCIETY.—Imperial College of Science, Imperial Institute-road, South Kensington, S.W. Twentieth Annual Exhibition.

WEDNESDAY, JANUARY 8TH.

INSTITUTE OF FUEL.—In the Rooms of the Chemical Society, Burlington House, Piccadilly, London, W. 1. "Fuel Economisers with Special Reference to their Construction, Materials and Recent Developments," by Mr. O. Kubalek. 6 p.m.

INSTITUTION OF HEATING AND VENTILATING ENGINEERS.—Swedenborg Hall, 20, Hart-street, Bloomsbury, W.C. 1. "Combustion, Wind and Flue Equipment," by Mr. C. A. Masterman. 7 p.m.

INSTITUTION OF SANITARY ENGINEERS.—Denison House, 296, Vauxhall Bridge-road, S.W. 1. Presidential address. 7.30 p.m.

THURSDAY, JANUARY 9TH.

BRITISH ASSOCIATION OF REFRIGERATION.—The Hall of the Institution of Mechanical Engineers, Storey's-gate, St. James's Park, London, S.W. 1. "Some Considerations in Design of Modern Refrigerating Plant," by Mr. B. C. Oldham, followed by discussion. 5.30 p.m.

INSTITUTE OF METALS: LONDON LOCAL SECTION.—In the Rooms of the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, S.W. 1. "The Aluminium Industry," by Mr. George Mortimer. 7.30 p.m.

INSTITUTION OF CIVIL ENGINEERS: BIRMINGHAM AND DISTRICT ASSOCIATION.—In the Chamber of Commerce, New-street, Birmingham. "The Design and Construction of Superimposed Sewers," by Mr. R. L. Lee. 6 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS.—In the Lecture Theatre of the Institution, Savoy-place, Victoria Embankment, W.C. 2. "Recent Developments in the Protection of Three-phase Transmission Lines and Feeders," by Mr. T. W. Ross and Mr. H. G. Bell. 6 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS: TEES-SIDE BRANCH.—Bolbec Hall, Newcastle-on-Tyne. "Locomotives for Industrial Purposes and their Maintenance," by Mr. J. W. Hobson. 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—In the Lecture Theatre of the Institution of Electrical Engineers, Savoy-place, Victoria Embankment, W.C. 2. Christmas Lectures Adapted to a Juvenile Audience. "How Things were Done in Ancient Egypt: vi., Hieroglyphs," by Mr. S. R. K. Glanville. 3 p.m.

FRIDAY, JANUARY 10TH.

CHEMICAL ENGINEERING GROUP.—In the Rooms of the Chemical Society, Burlington House, Piccadilly, London, W. 1. "Autogenous Welding in Chemical Works," by Mr. J. R. Booer, B.Sc. 8 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, London, S.W. 1. "The Track Circuit in Railway Signalling," by Mr. H. J. N. Riddle. 7.30 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Bolbec Hall, Newcastle-upon-Tyne. "Design and Construction of the Rail Car Carrying Steamship 'Seatrain,'" by Mr. L. C. Burrill, B.Sc. 6 p.m.

MONDAY, JANUARY 13TH.

INSTITUTE OF METALS: SCOTTISH LOCAL SECTION.—In the Rooms of the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank-crescent, Glasgow. "Extrusion, and a Consideration of Some of the Physical Properties Affecting the Production of Rods, Tubes and Sections of this Process," by Mr. A. Wragg. 7.30 p.m.

INSTITUTE OF TRANSPORT.—At the House of the Institution of Electrical Engineers, Savoy-place, Victoria Embankment, W.C. 2. At this meeting Mr. Ashton Davies will submit for discussion a paper on "The Co-ordination of Transport," instead of upon the subject originally selected, namely, "Air Transport in Relation to Railways." 5.30 p.m.

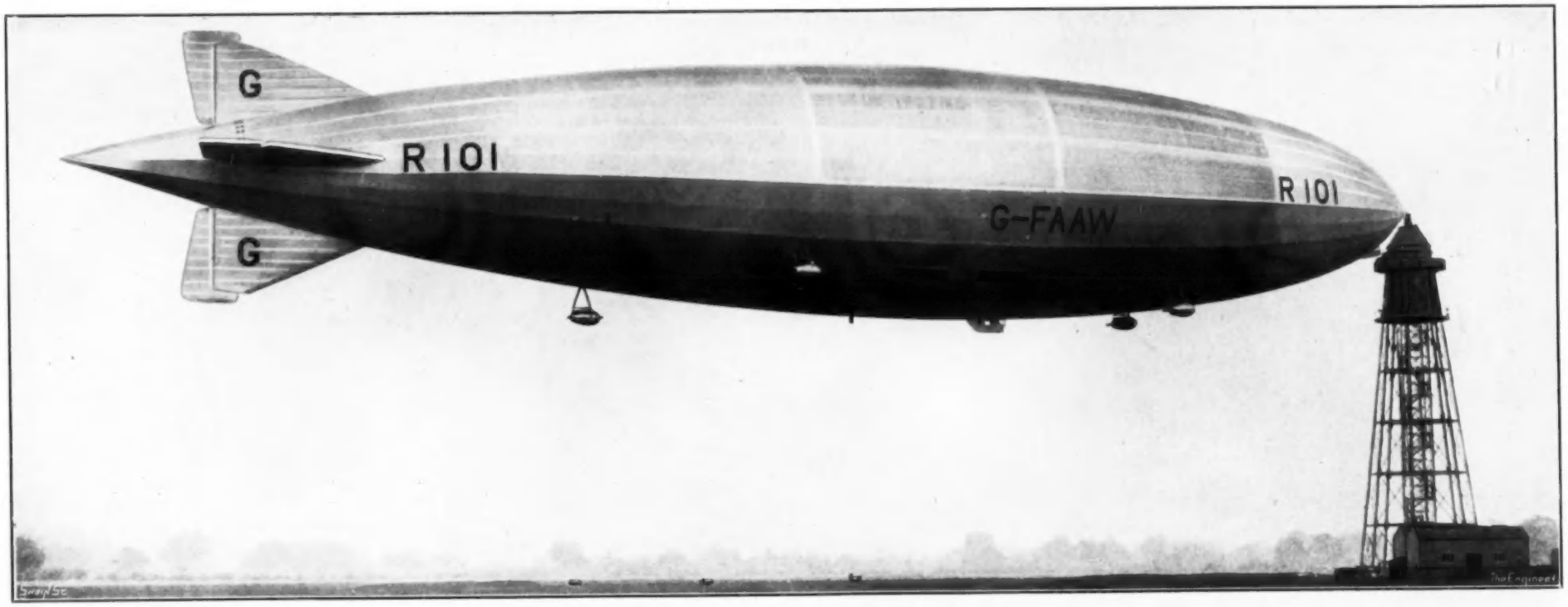
INSTITUTION OF AUTOMOBILE ENGINEERS.—Queen's Hotel, Birmingham. "Petrol-electric Vehicle Characteristics," by Mr. C. R. F. Engelbach. 7 p.m.

TUESDAY, JANUARY 14TH.

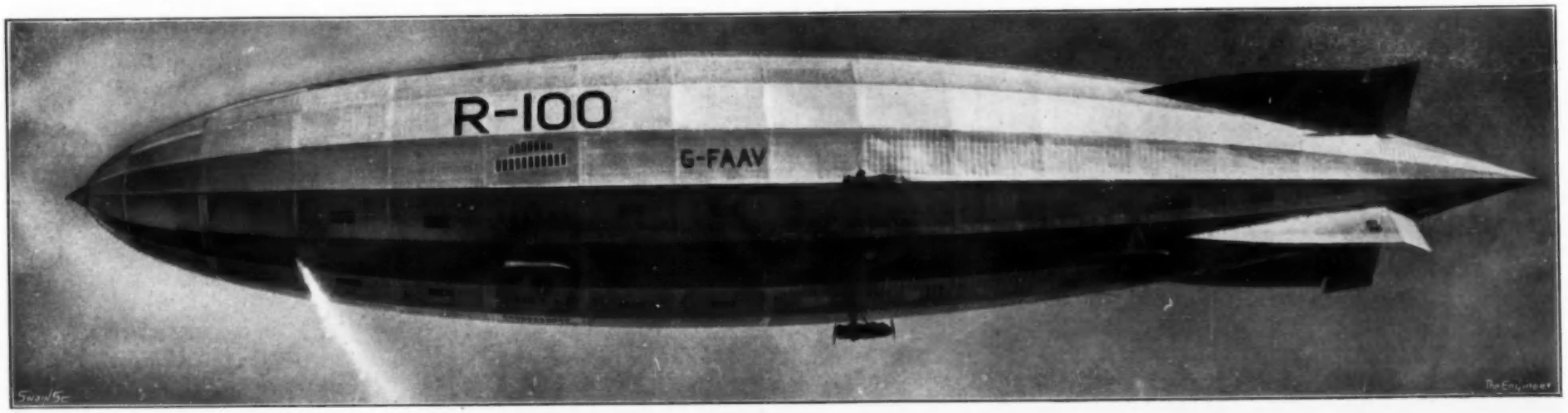
ASSOCIATION OF EX-SIEMENS' MEN.—Gatti's Restaurant, King William-street, Strand, W.C. 2. Smoking concert.

INSTITUTE OF MARINE ENGINEERS.—The Minories, London, E.C. 3. "Water-tube Boilers for Merchant Ships," by Engineer Rear-Admiral W. M. Whayman. 6.30 p.m.

INSTITUTE OF METALS: NORTH-EAST COAST LOCAL SECTION.—In the Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne. "Chromium Plating," by Mr. L. Wright. 7.30 p.m.

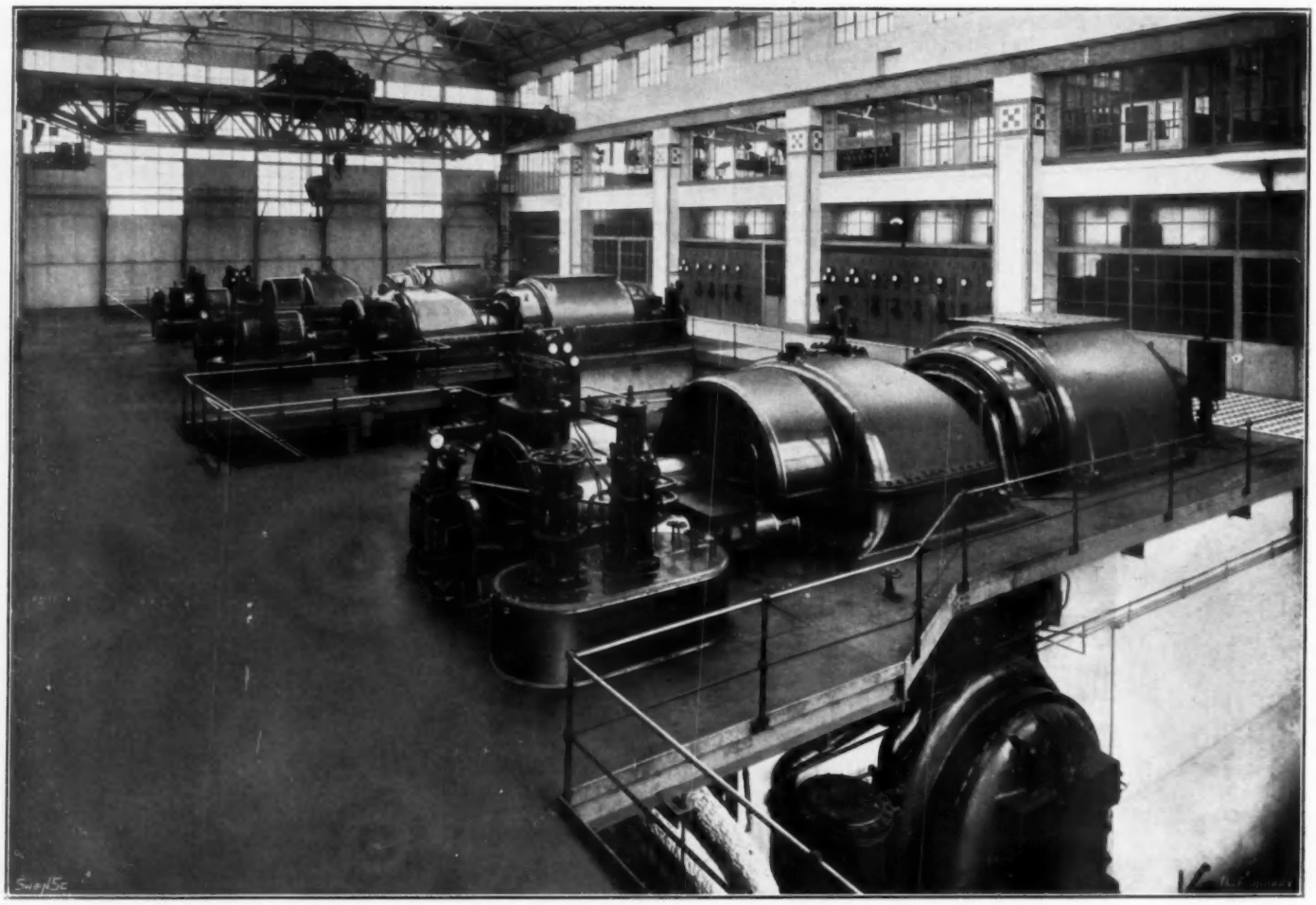


H.M. AIRSHIP R 101 AT THE CARDINGTON MOORING TOWER

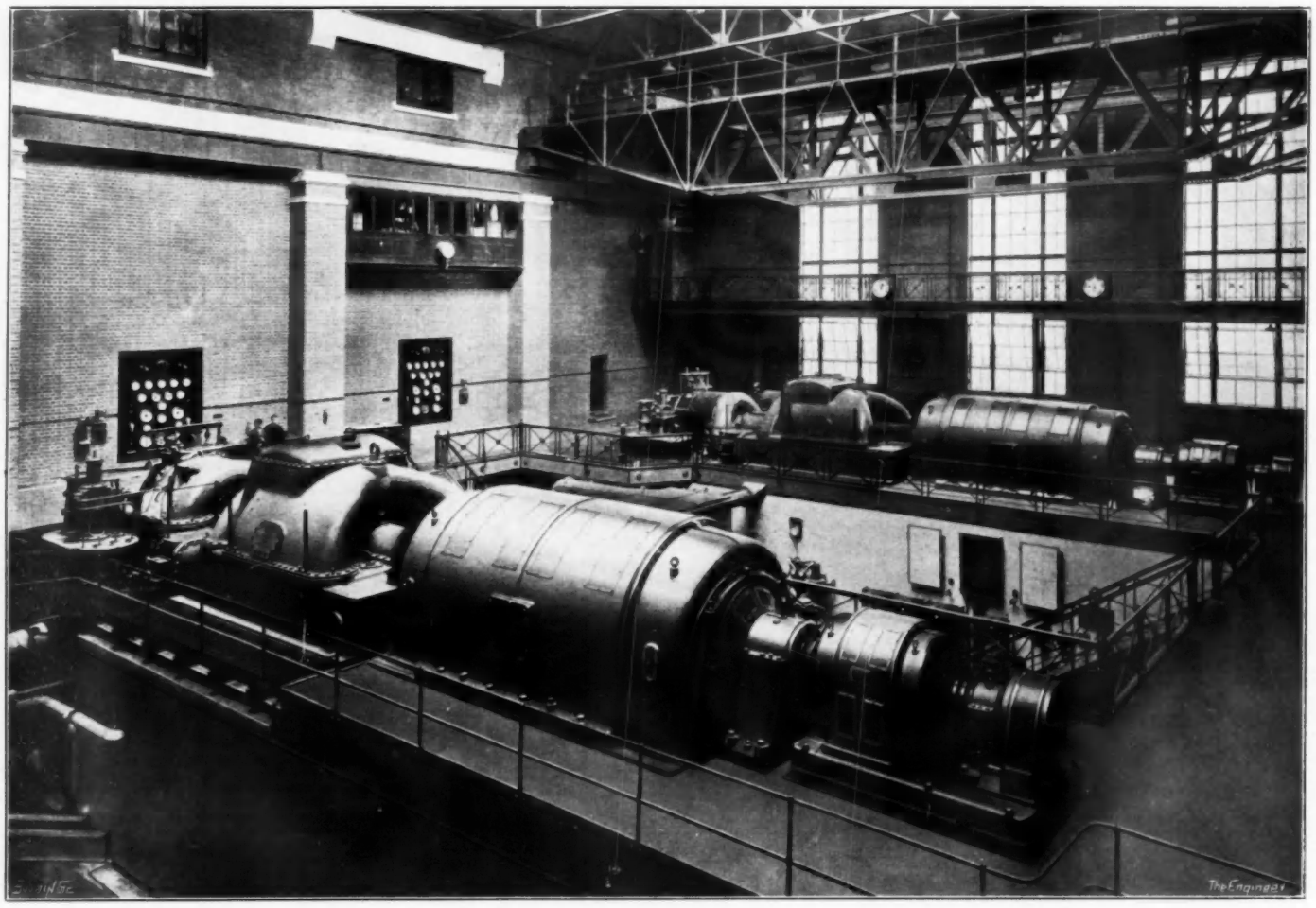


H.M. AIRSHIP R 100 IN FLIGHT—DISCHARGING WATER BALLAST

SOME POWER STATIONS OF 1929

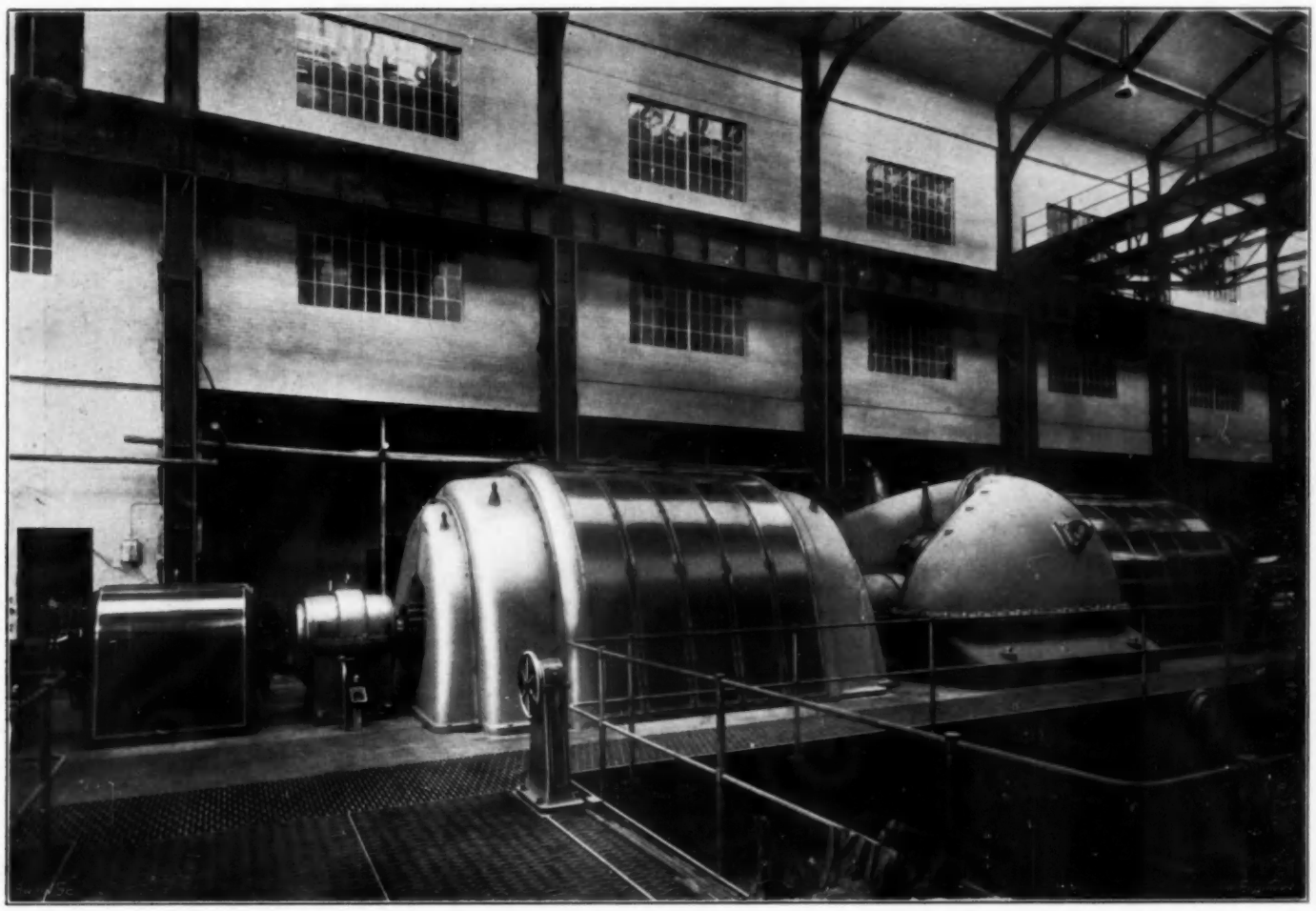


Slacks Valley Power Station

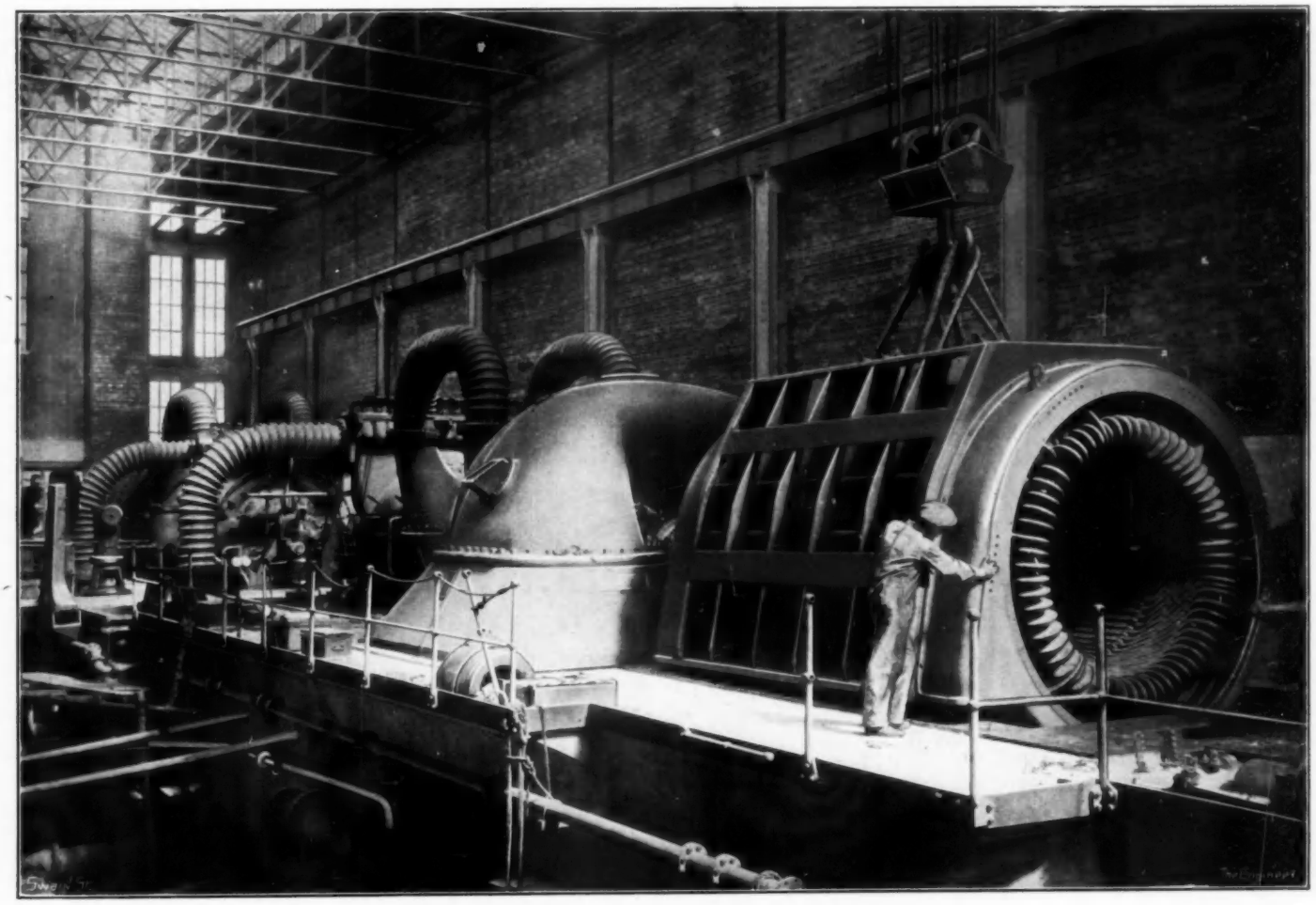


Portishead Power Station

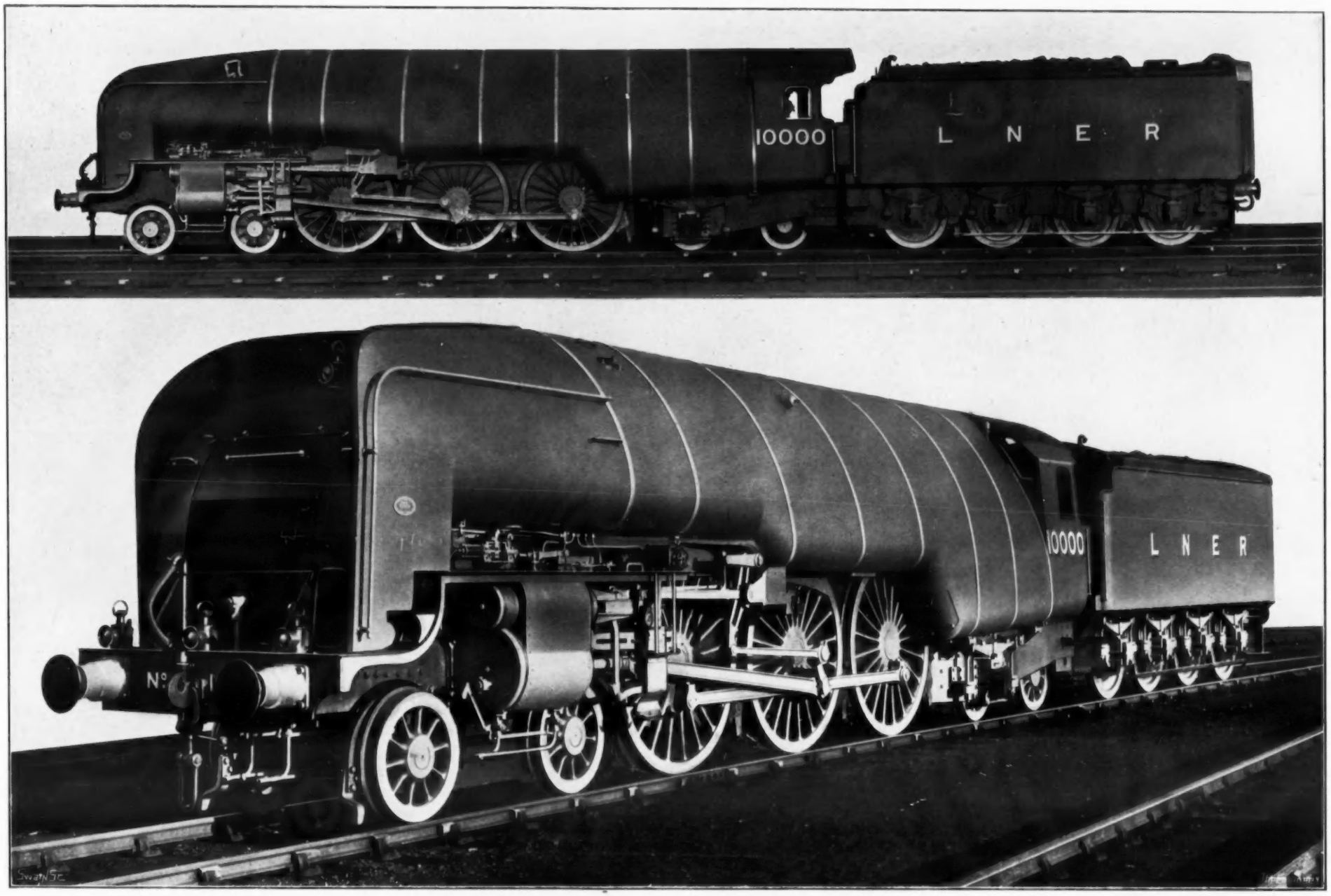
SOME POWER STATIONS OF 1929



37,500-kVA Turbo-Alternator—Hams Hall Power Station

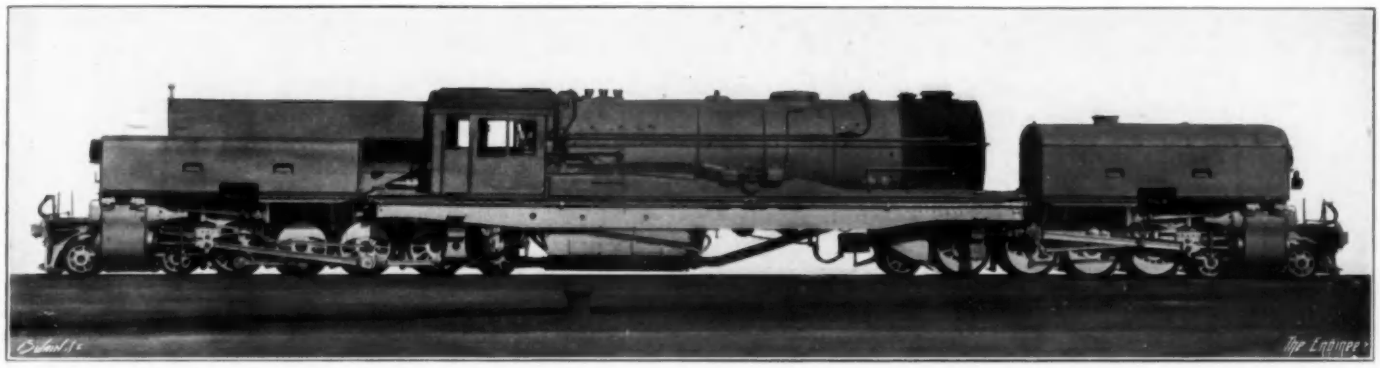


32,000-kW Turbo-Alternators—Kearsley Power Station

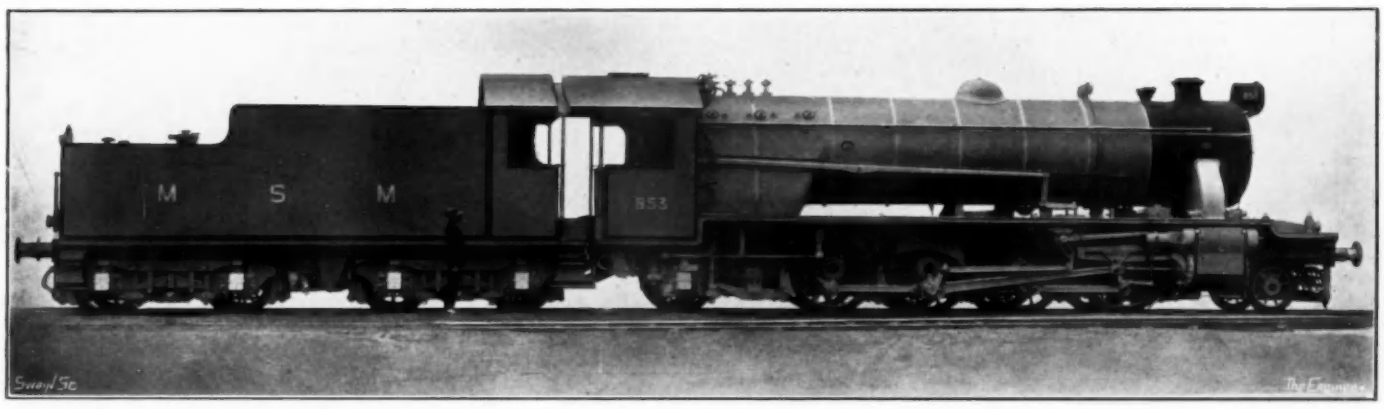


L.N.E.R. HIGH-PRESSURE FOUR-CYLINDER COMPOUND LOCOMOTIVE

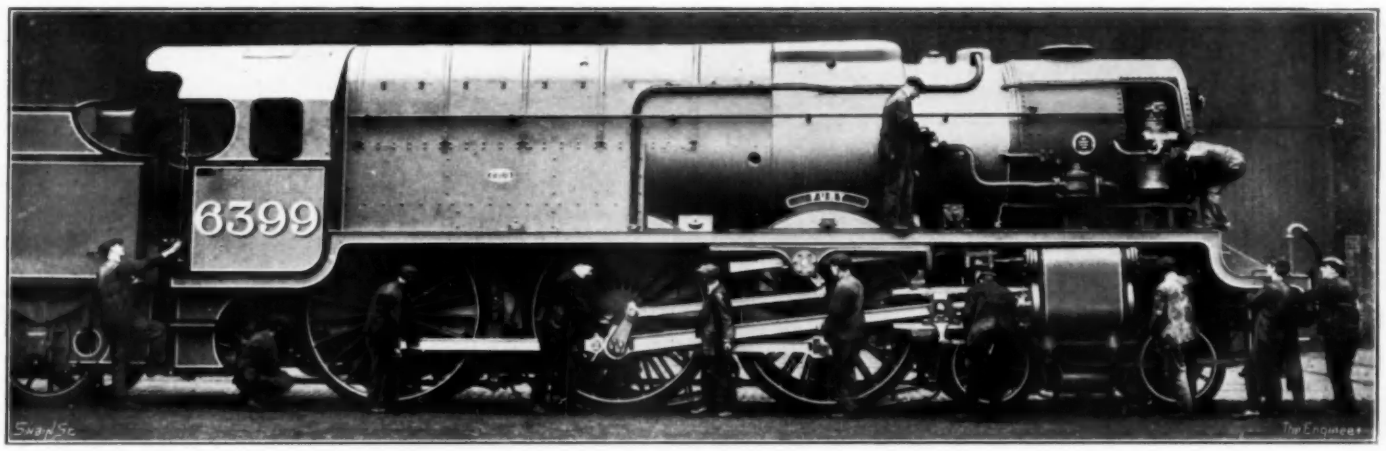
SOME LOCOMOTIVES OF 1929



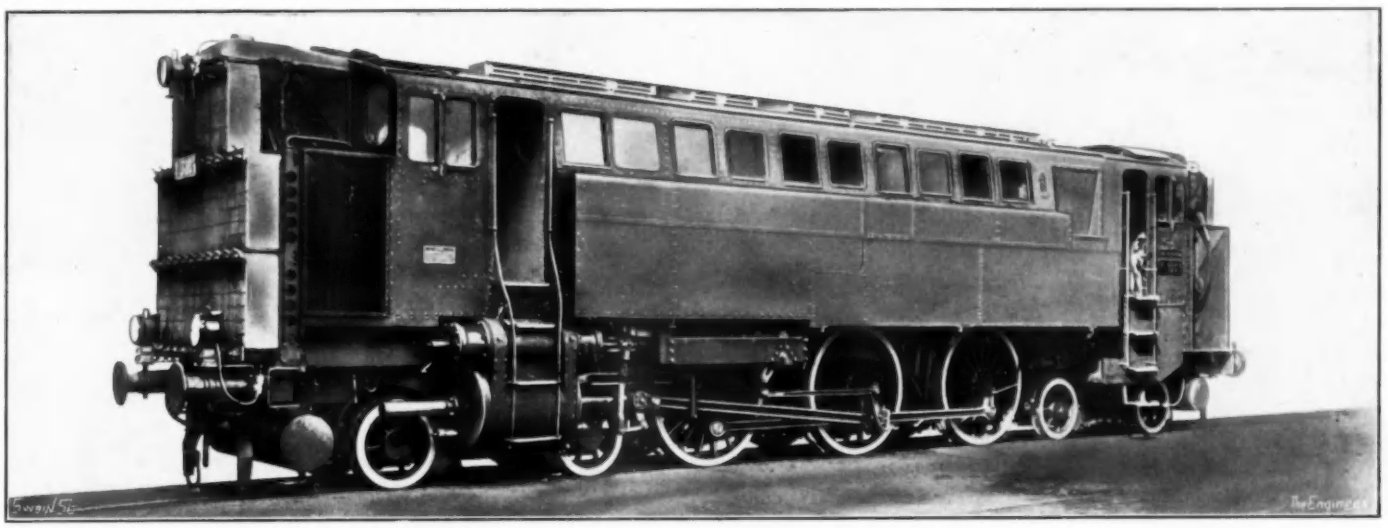
SOUTH AFRICAN RAILWAYS—BEYER-GARRATT LOCOMOTIVE—BEYER, PEACOCK



MADRAS AND SOUTHERN MAHRATTA RAILWAY—GOODS LOCOMOTIVE—ARMSTRONG

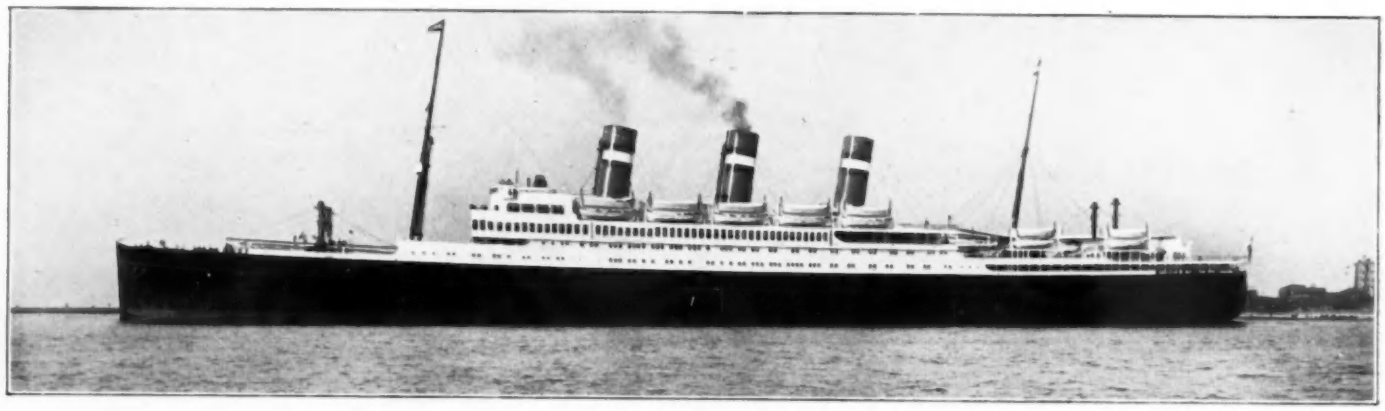


L.M.S. RAILWAY—DOUBLE-PRESSURE LOCOMOTIVE—NORTH BRITISH

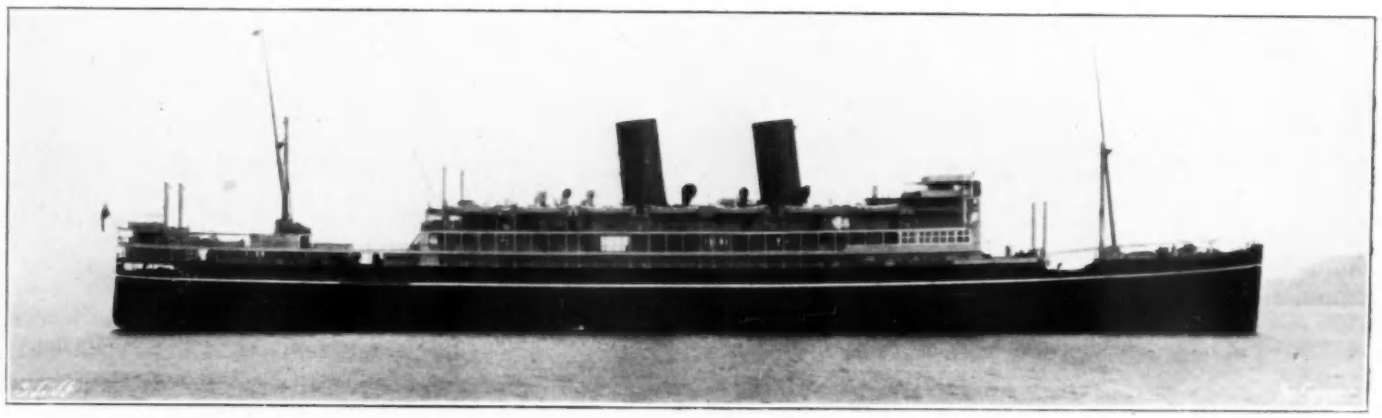


GERMAN STATE RAILWAYS—DIESEL-COMPRESSED-AIR LOCOMOTIVE

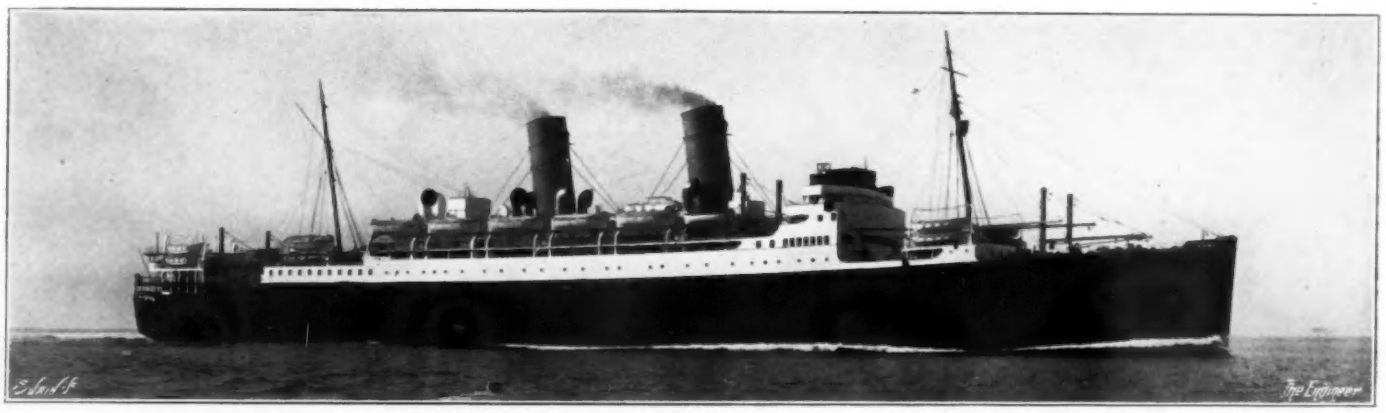
SOME STEAMSHIPS OF 1929



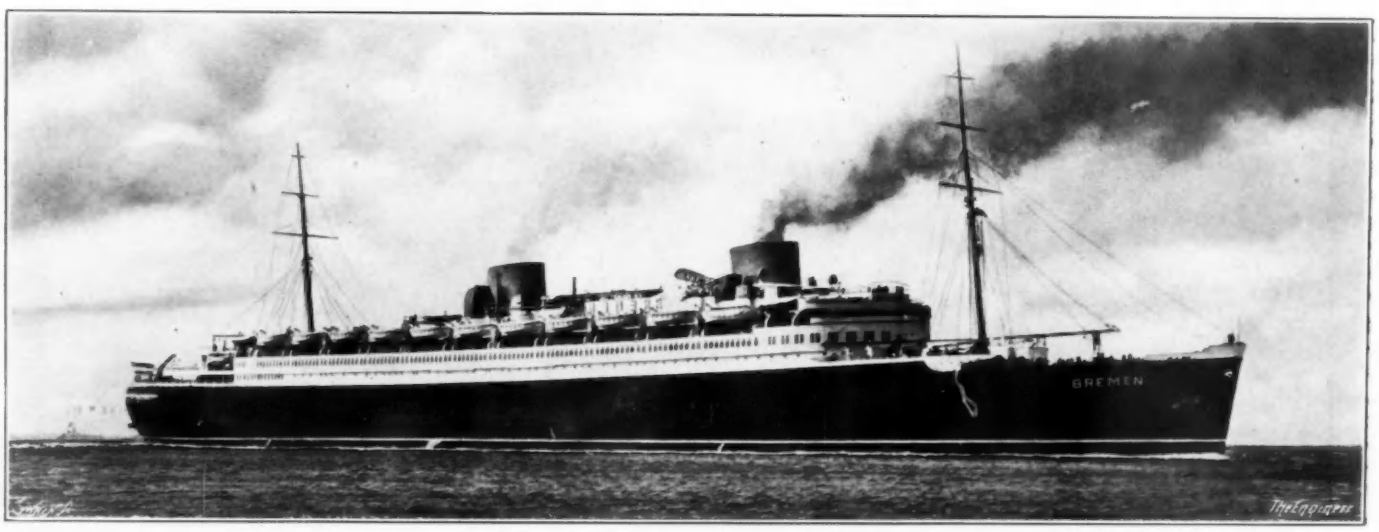
HOLLAND-AMERICA LINER STATENDAM



P. AND O. LINER VICEROY OF INDIA

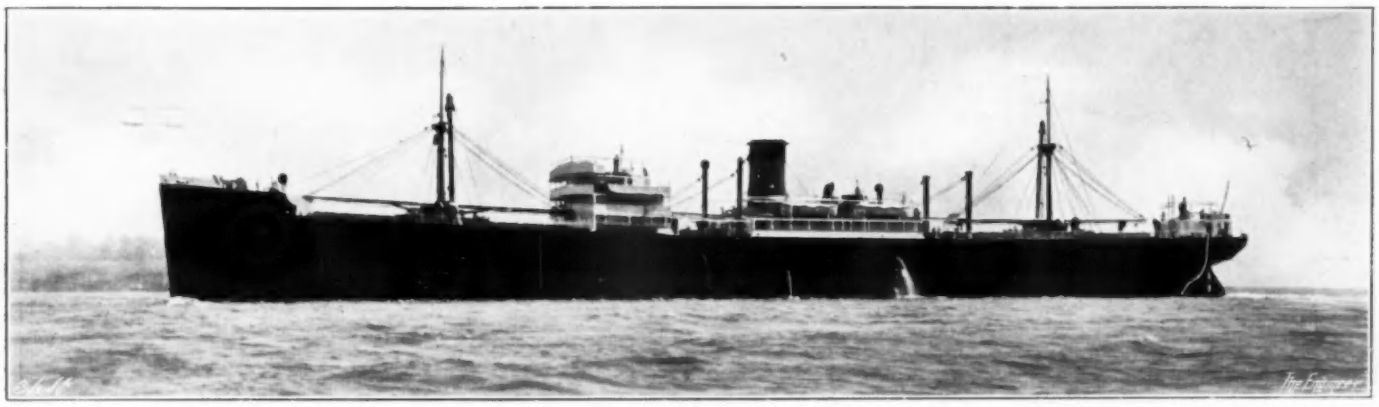


CANADIAN PACIFIC LINER DUCHESS OF YORK

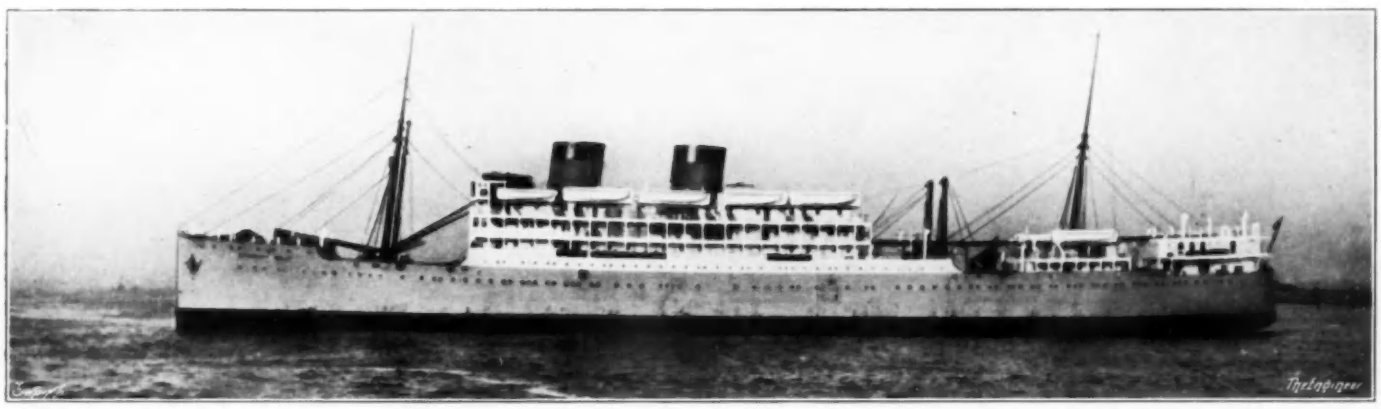


NORTH GERMAN LLOYD LINER BREMEN

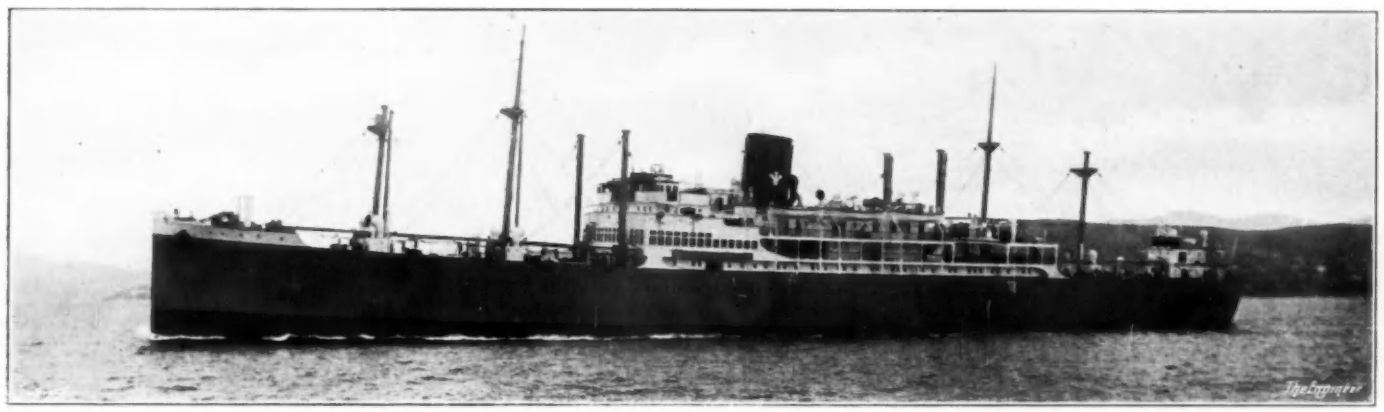
SOME MOTOR SHIPS OF 1929



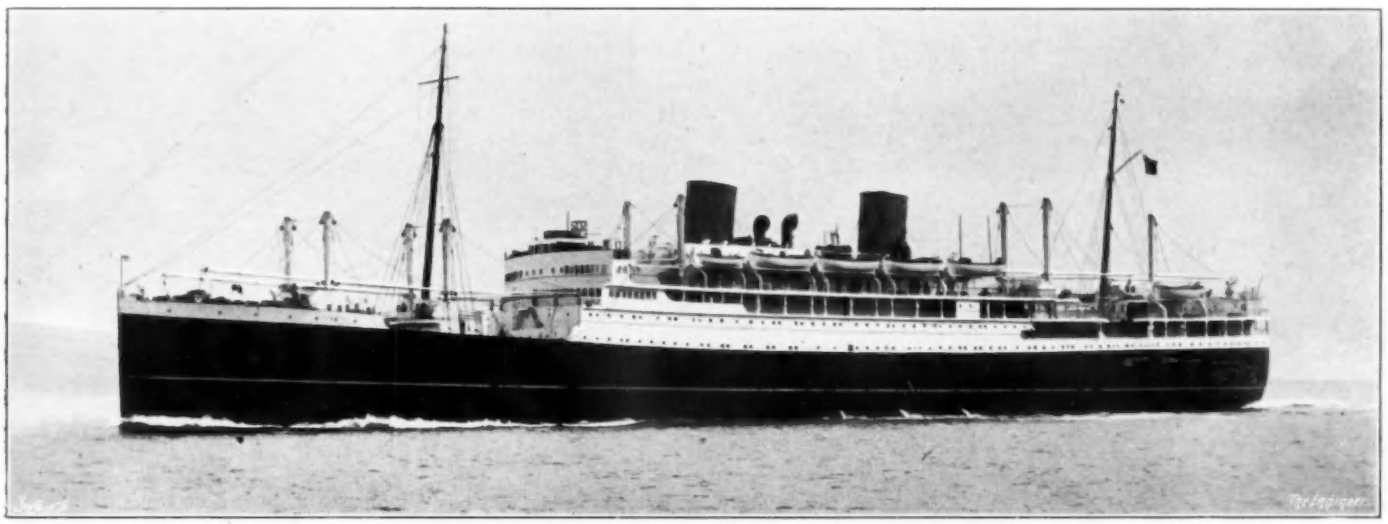
Lancashire Shipping Co.'s Motor Ship Thurland Castle



Union-Castle Motor Liner Llangibby Castle



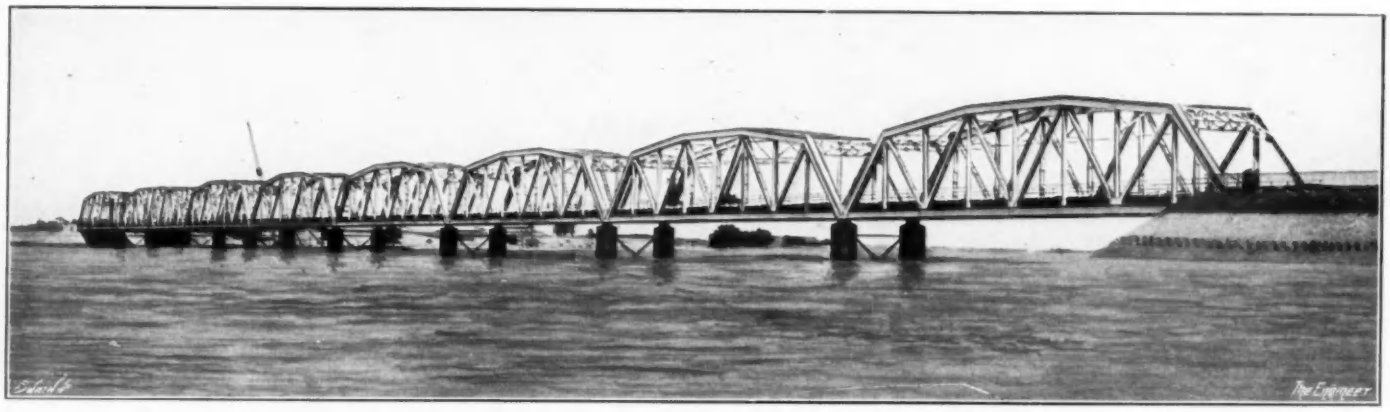
Prince Line Motor Ship Southern Prince



New Zealand Shipping Co.'s Motor Liner Rangitata

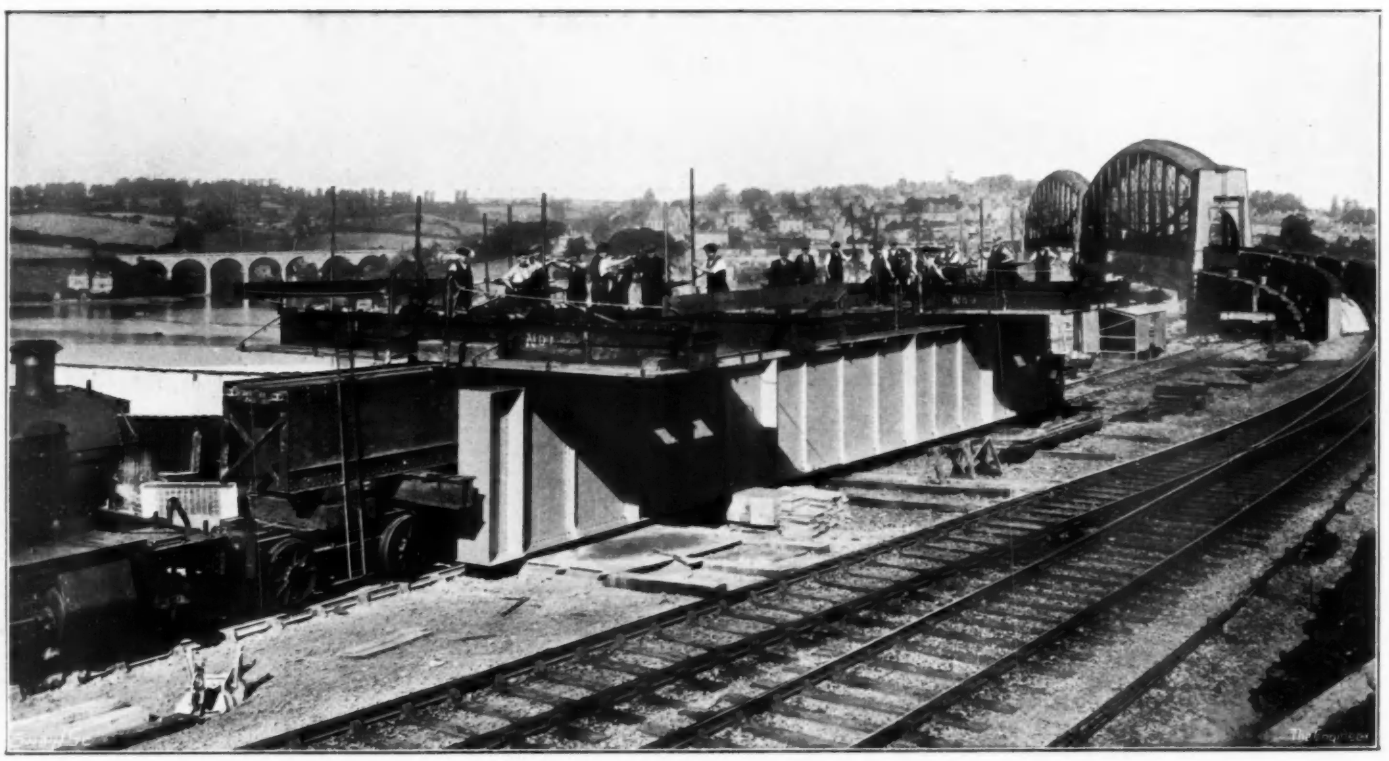
UNIV OF WIOA

SOME CIVIL ENGINEERING WORKS OF 1929



THE KHARTOUM-OMDURMAN BRIDGE

TILBURY DOCKS—NEW ENTRANCE LOCK AND ROLLING LIFT BRIDGE



ROYAL ALBERT BRIDGE, SALTASH—RECONSTRUCTION OF THE LAND SPANS